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Drainage, Streptomycin and Tuberculosis*

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To understand the reason for the usual development and progression of pulmonary tuberculosis in the apex of the lung, or more specifically in the dorsal and cephalic portions of all pulmonary lobes, is to have a better understanding of the pathogenesis of this disease. Having this knowledge, the investigator may evaluate correctly and with satisfaction results obtained in the treatment of the disease.

Macklin has described the "restricted movements of the bronchial tree in the area of the human lung which lies between the root zone and the fixed wall behind and above the root region." It has long been my belief that lack of free drainage from the lungs and bronchial tree in these locations, due to comparative lack of mobility of the lung, is responsible not only for the prevalence of tuberculosis in these locations, but for its progression and chronicity. Detailed explanation of this statement may be found in several published articles by the author since 1938.

The normal cleansing mechanism consists of: (1) The cough mechanism. (2) The ciliary action, and (3) The peristalsis like action of the bronchial tree during respiration. During inspiration the bronchial tree elongates and the diameters of the lumina of the bronchi become wider. During expiration, the bronchi shorten and their lumina are narrower. This latter mechanism may play a large part in the evacuation of exudates which may accumulate within the bronchial tree and where free drainage is instituted, disease may be prevented, or where disease already exists, it may clear.

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Unfavorable conditions affecting adversely the normal mechanism of drainage from the bronchial tree, such as partial blockage by endobronchial tuberculosis, or by peribronchial fibrosis or loss of mobility as in complete consolidation of a lobe, would be conducive to the retention of infectious exudates and the spread of the disease. This is purely mechanical and has nothing to do with lack of immunity of the individual.

The secret to the favorable results which may follow collapse therapy is the institution of free and adequate drainage of infectious exudates from the lungs and bronchial tree. This statement has been made by the author in a number of published articles since 1940.

The mechanics of the collapse in artificial pneumothorax is different, however, to that of artificial pneumoperitoneum. In my opinion, artificial pneumothorax is contraindicated in the presence of endobronchial disease. Bronchoscopic examination should be made where pneumothorax is being considered. By so doing, atelectasis and inexpandable lung, as a result of it, may be prevented. Where tension cavity is present, artificial pneumothorax usually makes matters worse. Compression over the cavity narrows the already partially blocked bronchus leading to the cavity with the result that the blockage becomes more complete, the cavity becomes larger and under greater tension. Air can still enter on inspiration, but on expiration, the air can not escape. When such cavities close following re-expansion of the lung, the cause is believed to be due to the re-establishment of adequate drainage through an alteration of the check valve mechanism. This is accomplished through a widening of the lumen of the bronchus leading to the cavity.

Pneumoperitoneum with or without phrenemphraxis has a remarkable effect on the closure of tension cavities. Not only is the check valve mechanism altered following this procedure, but drainage of infectious exudates from the lungs and bronchial tree is facilitated. This free drainage of exudates also allows for healing of the endobronchial lesion, since retention of infectious exudates at the site of its development is considered to be the chief factor in its pathogenesis.

The optimum level of the diaphragm in pneumoperitoneum patients is that level which permits of absolute ease of expectoration. After studying clinically large numbers of pneumoperitoneum patients in recent years, it has become increasingly clear that the ease of expectoration or the free drainage which occurs following the induction of therapy is the secret to the clearing of the pathological process. One cannot but be impressed also by the fact that rarely does bronchogenic spread occur when free

and adequate drainage exists. In these studies, it has frequently been observed that drainage may be made so free in acute bilateral advanced disease with tension cavity formation in the negro, that complete clearing of the disease occurs. Such disease has in the past been considered the type which eventuates in fatality. Certainly no other form of collapse therapy at our disposal has produced such remarkable results. Such results should modify our beliefs relative to the pathogenesis of pulmonary tuberculosis.

A large factor affecting adversely the drainage mechanism in the negro is the loss of mobility of the lung due to the frequent occurrence of consolidation.

Artificial pneumothorax should not be given in acute pneumonic tuberculosis nor in cases associated with endobronchial disease. The indications for artificial pneumothorax today are limited. In my opinion pneumoperitoneum not only has wider indications, but its use is accompanied by fewer serious complications.

Having discussed at some length the normal mechanism of drainage from the lungs and bronchial tree and how it may be assisted by collapse therapy, it will be my endeavor to show how drainage combined with streptomycin influences the course of tuberculous processes not only in the lungs, but in various locations of the body.

Streptomycin and Drainage in Pulmonary Tuberculosis

It has been observed on numerous occasions that young individuals with fresh pneumonic tuberculosis respond unusually well to streptomycin therapy. Some of these patients in fact go on to complete clearing of the pathological process. On the other hand, individuals who have developed fibrotic changes with or without cavity formation and who also have an exudative component do not respond as well to streptomycin therapy. There is evidence to show that streptomycin through its suppressant action on the tubercle bacillus retards the formation of exudates. In the individual with fresh pneumonic tuberculosis without fibrotic changes, free drainage usually follows streptomycin therapy and continues unhampered through an unchanged anatomical bronchial tree. Most of these patients who have had difficult expectoration previous to therapy begin to expectorate freely and with ease after therapy has been started.

If early and adequate drainage is not brought about in these cases, however, permanent productive and fibrotic changes take place in the lung. In such cases the drainage mechanism becomes permanently altered. This fact not only accounts for less favorable results following streptomycin therapy in these cases, but

it is also believed to account for the more frequent recurrences of active disease.

In chronic pulmonary tuberculosis, it is not unusual to see a clearing of a fresh pathologic process in one area of the lung and a spreading of the process in another. This can be explained on the basis of adequate drainage on the one hand and inadequate drainage on the other.

It has been generally accepted that streptomycin therapy in conjunction with collapse therapy in this type of case is the treatment of choice. The mechanism of drainage brought about by collapse therapy has been described above. In some advanced pneumonic cases in the negro, it may be impossible to initiate adequate drainage following streptomycin therapy because of the solidity of the lung. The outcome in such cases is regularly unfavorable.

Streptomycin and Drainage by Cavernostomy

Giant cavities will occasionally close following the introduction of artificial pneumoperitoneum. Where this does not occur, however, following a trial period of six months open cavernostomy combined with streptomycin therapy should be tried. Surgeons in the past have not accepted cavernostomy as a method of choice in the treatment of giant tension cavities or residual cavities following throacoplasty because of technical difficulties and dangers which accompany the operation. The chief reason why cavernostomy has not been looked upon with favor, however, is perhaps because adequate drainage was not effected over sufficient time to render the drainage material negative for tubercle bacilli. The Eloesser technique of open drainage of tension cavities has recently been used with considerable success and no doubt because the above requisites have been met. Murphy et al, have recently reported excellent results in the use of the Eloesser technique of open cavernostomy combined with streptomycin in 11 patients with residual cavities following thoracoplasty. The sputum was converted in 10 of the patients and six of the sinuses closed without surgical aid. One of the patients died.

Four open cavernostomies have been performed in this hospital recently with striking clinical results. One of them deserves special mention as follows: T.K., age 22, was admitted to the hospital on May 3, 1948, with a diagnosis of far advanced pulmonary tuberculosis and laryngeal tuberculosis. There was a giant tension cavity in the right apex, and a recent bronchogenic spread to the left lung. The symptomatology and the type of spread were typical of those seen so frequently in association with endobronchial disease and tension cavity. Streptomycin therapy tempo-

rarily relieved to some extent the symptomatology, and there was a clearing of the process in the left lung. Six weeks after the beginning of streptomycin therapy, a spread on the left side to its original intensity had occurred. Closed cavity drainage with continuous suction instituted on July 15, 1948 was ineffective and at the time of removal of the tube on August 23, 1948, x-ray films revealed a spread to the right base. Another course of streptomycin was given, and during treatment an x-ray film taken on September 13, 1948 revealed an extension of the pathological process to have taken place, under the cavity on the right side. At this time a high degree of resistance of the tubercle bacilli to streptomycin had developed. Since admission to the hospital, the patient had been clinically active with elevation of temperature, irritable cough with difficult expectoration, and had shown continuous spread of the disease. His appetite had been poor and he had lost weight. There had been improvement, however, of his laryngeal tuberculosis. An Eloesser type of cavernostomy was performed following the second course of streptomycin therapy, and since that time drainage has been free. At first it was purulent and copious. At present it has diminished considerably in amount and is thinner in consistency. The patient no longer has difficult expectoration and is clinically non-active. He has a good appetite and is gaining in weight. The x-ray films recently have shown continuous clearings and the cavity has diminished greatly in size. This demonstrates dramatically the role that free drainage plays in active pulmonary tuberculosis—even where a high resistance of the organisms to streptomycin has developed.

Streptomycin and Surgical Drainage of Tuberculous Sinuses

One of the most impressive results in the treatment of tuberculosis in man by streptomycin has been obtained following its use in draining tuberculous sinuses. In the original article published on this subject by the author, it was recognized that closure of the sinuses was more prompt when free drainage was present. It was demonstrated that when small abscesses exist under the skin and the sinuses are not draining adequately, the areas should be incised and the pus evacuated. It has also been shown that where necrotic bone or cartilage is present, as for example in a rib or sternum, this necrotic material should be removed. When this is done, streptomycin accelerates healing.

When a large cold abscess exists in conjunction with tuberculosis of the vertebrae, there is little tendency for the pus to disappear under streptomycin therapy unless it is evacuated by open drainage. When, however, the large surgically made sinuses are allowed to drain while streptomycin therapy is being carried

out, they fill in quickly and close. Healing in 95 per cent of sinus cases treated with streptomycin may be obtained where free surgical drainage exists, otherwise the percentage of healing is not so great.

Streptomycin and Excision Surgery for Fistulae

Fistulae do not respond nearly so well to streptomycin as do sinuses when treated without surgical intervention. However, where the fistula is excised the lesion completely heals and remains so. Of the original series of 15 fistulae excised at Veterans Hospital, Oteen, North Carolina, and reported by Murphy, 100 per cent healed. Since that time this author treated 19 cases of rectal fistulae with streptomycin and resection therapy. Seventeen of these healed and two improved.

Streptomycin in the Treatment of Tuberculous Lesions Located on Surface Areas

It has been frequently observed that tuberculous lesions occurring on the tongue or in canalicular organs such as the larynx, the bronchi, and the intestines heal readily under streptomycin therapy. On such surface areas, free drainage may occur from the lesions following the suppressant action of streptomycin on the offending organism with the result that a high percentage of healing takes place.

On the other hand, lesions in other organs such as the brain and kidneys do not respond as well to therapy partially at least because of the absence of these free drainage facilities. Although the immediate results obtained in the use of streptomycin in tuberculous meningitis have been outstanding, the eventual outcome in these cases is relatively poor. It is believed that the original caseous foci within the brain substance may emit showers of tubercle bacilli which in turn would be responsible for the recurrence of active tuberculous meningitis. According to Baggenstoss, Feldman and Hinshaw, streptomycin does not penetrate the substance of the brain in appreciable amounts, and for this reason would have no influence on the bacilli within the caseous foci. From a theoretical standpoint, one might assume under these conditions that the bacilli within the caseous foci in the brain would always remain sensitive to streptomycin provided these foci were in fact original foci and had never made contact with streptomycin. It would also be logical under these conditions to continue streptomycin therapy over a much longer period of time than is the custom at present in this country. Such a course of therapy might prevent recurrences of meningitis in that the strep-

tomycin would have immediate effect upon bacilli which might be emitted from the original foci.

Flory et al, and Auerbach and Stemmerman have observed healing tubercles in the pons and the former infer that streptomycin must have been responsible for the healing, which is contrary to the belief of Baggenstoss, Feldman and Hinshaw. However, the small amount of healing that has been observed in the substance of the brain may be due in part to the lack of drainage from the brain.

CONCLUSION

In conclusion, it is of interest to speculate on the possible correlation between the degree of drainage from a tuberculous focus located in any part of the body, and the development of resistance of tubercle bacilli to streptomycin.

In general it has been shown that when clearing of the lesion is taking place in a satisfactory manner, resistance of the organisms to streptomycin does not develop. Conversely where streptomycin does not affect an early favorable result, an increasing resistance of the organisms is the rule. A lack of adequate drainage may play a definite role in the development of resistance.

CONCLUSION

En conclusión, es interesante especular sobre la posible correlación entre el grado de canalización de un foco tuberculoso localizado en cualquier parte del cuerpo y el desarrollo de resistencia del bacilo tuberculoso frente a la estreptomicina.

En general, se ha demostrado que cuando la limpieza de la lesión ocurre de manera satisfactoria, la resistencia del organismo a la estreptomicina no se desarrolla.

Inversamente cuando la estreptomicina no afecta una lesión tempranamente, un aumento de la resistencia de los gérmenes es la regla.

Una falta de adecuado drenaje puede desempeñar un papel definido en el desarrollo de resistencia a la estreptomicina.

REFERENCES

Amberson, J. Burns: Personal Communication.

Auerbach, Oscar and Stemmerman, G. N.: "Anatomic Change in Tuberculosis following Streptomycin Therapy," *Am. Rev. Tuberc.*, 58:449, 1948.

Baggenstoss, A. H., Feldman, W. H. and Hinshaw, H. C.: "Streptomycin in Miliary Tuberculosis," *Am. Rev. Tuberc.*, 55:54, 1947.

Banyai, A. L.: "Pneumoperitoneum Treatment," St. Louis, *The C. V. Mosby Co.*, 1946.

Brock, Benjamin L. and Woodson, T. Ashby: "Postural Treatment of Pulmonary Tuberculosis," *Ky. Med. Jour.*, (Aug.) 1938.

Brock, Benjamin L. and Woodson, T. Ashby: "Elevation of the Foot of the Bed in the Treatment of Pulmonary Tuberculosis," *Am. Acad. Tuberc. Phys.*, (Aug.) 1939.

Brock, Benjamin L.: "Pathogenesis and Localization of Pulmonary Tuberculosis," *Am. Rev. Tuberc.*, 42:755, 1940.
Brock, Benjamin L.: "Further Observations on the Pathogenesis and Localization of Pulmonary Tuberculosis," *Sou. Med. Jour.*, 34:434, 1941.
Brock, Benjamin L.: "The Role of the Bronchial Tree in the Pathogenesis of Pulmonary Tuberculosis," *Sou. Med. Jour.*, 35:984, 1942.
Brock, Benjamin L.: "The Role of the Bronchial Tree in the Pathogenesis of Pulmonary Tuberculosis," *Dis. of Chest*, 10:123, 1944.
Brock, Bnjamin L.: Discussion of Paper by Bobrowitz, I. D.: "Treatment of Tension Cavities with Pneumothorax," *Dis. of Chest*, 13:133, 1947.
Brock, Benjamin L.: "The Role of the Bronchial Tree in the Pathogenesis of Pulmonary Tuberculosis. Fundamentals of Tuberculosis and Its Complications," *Charls C. Thomas*, Publishers, 1949.
Brock, Benjamin L.: "Streptomycin in the Treatment of Draining Tuberculous Sinuses," *J.A.M.A.*, 135:147, 1947.
D'Esopo, N. D. and Steinhaus, J. E.: "Streptomycin Therapy in Pulmonary Tuberculosis," *Am. Rev. Tuberc.*, 56:589, 1947.
Hayes, J. N.: "Present Status of Therapeutic Pneumothorax," *Am. Rev. Tuberc.*, 58:476, 1948.
Macklin, C. C.: "The Dynamic Bronchial Tree," *Am. Rev. Tuberc.*, 25: 393, 1932.
Medlar, E. M.: "The Pathogenesis of Minimal Pulmonary Tuberculosis," *Am. Rev. Tuberc.*, 58:583, 1948.
Murphy, J. D., Elrod, P. D., Walkup, H. E. and Koontz, E. R.: "Surgical Treatment of Residual Cavities Following Thoracoplasties for Tuberculosis," *Dis. of Chest*, 14:694, 1948.
Parnall, C. Jr., Brock, Benjamin L. and Moyer, R. E.: "Streptomycin in the Treatment of Pulmonary Tuberculosis," *Am. Rev. Tuberc.*, 56:565, 1947.
Streptomycin Committee, Veterans Administration; Report to the Council on Pharmacy and Chemistry: "Streptomycin in the Treatment of Tuberculosis," *J.A.M.A.*, 138:584, 1948.

The Physiological Significance of Bronchiectasis*

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Bronchiectasis is a disease characterized by pathological enlargement of one or more bronchi or bronchioles. The dilatation per se, however, is not the most important pathological factor. The dilatation is only the demonstrable effect of a pathological process which damages the tissues of the lungs and bronchi sufficiently to interfere with their function.

Pathology

Examination of bronchiectatic bronchi reveals the loss of normal columnar ciliated epithelium. This is replaced in some instances by purely cicatricial tissue, and in others by a stratified squamous cell epithelium. The basement membrane of the mucosa is likewise destroyed or damaged, and elastic tissue fibers disappear. The submucosa, normally a loose fatty connective tissue, becomes densely fibrotic and rigid. In the immediately adjoining lung parenchyma there appears to be laid down additional fibrosis which adds to the thickness and rigidity of the bronchial wall.

Associated with bronchiectasis one finds varying degrees of pulmonary atelectasis, pneumonitis and sclerosis. In advanced cases the affected lobe or lobule may be small, firm and contracted. There is no absolute knowledge as to whether the bronchiectasis is advanced because it exists in such a lobe, or whether the advanced bronchiectasis causes the lobe to assume these characteristics. If impairment of function is considered, it appears probable that each factor plays upon the other, producing a progressive and vicious cycle of events.

Physiology

To visualize the importance of the cleansing mechanism of the lungs and bronchi, observe a wire screen through which an exhaust fan has been blowing for a few days or weeks. Or consider a filter removed from an air conditioning unit after a season's use. It is the same air passing through each that must be inhaled, and it is apparent that without an effective means of self cleans-

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ing, the bronchi would become completely clogged within the first few months of life.

The major air passages from the trachea to the bronchioles are normally supplied with a columnar ciliated epithelium, and mucous and serous glands. Foreign particulate matter is enveloped in mucus and steadily swept towards the larynx by the cilia. A portion of the dust, dirt and pathogenic organisms is disposed of in this manner.

Peristaltic waves have been observed in the bronchi and are thought by some to play a part in the evacuation of secretions containing foreign or noxious matter.

Phagocytic leukocytes have been shown to ingest particles which reach the alveoli, and, with an amoeboid type of movement, to pass through the alveolar walls to enter the lymphatic streams. Through one system of lymphatic channels the undesired particles are carried to and deposited in the lymphatic glands located at the various bifurcations of the bronchial tree. Through the other, they are carried towards the periphery of the lung to be deposited beneath the pleura.

Perhaps the most important of all the protective mechanisms is the cough reflex, stimulated by the presence of a foreign substance in contact with the sensitive bronchial mucous membrane, or by the exclusion of air from a bronchus, as by the insertion of a bougie or the presence of a foreign body, a tumor or plug of mucus. The cough itself is picturesquely described by Chevalier Jackson as consisting of "the tussive squeeze and the becchic blast," which implies the necessity of air passing beyond the material to be evacuated (into alveolar air spaces) in order to provide the motivating force for its movement towards the mouth.

Consideration of the anatomical pathology found in bronchiectasis indicates at once the functional impairment to be overcome. The ciliated epithelium is destroyed and is not replaced. The rigidity of the walls of bronchiectatic bronchi precludes any possibility of bronchial peristalsis taking place. The atelectasis, pneumonitis or sclerosis of the surrounding lung parenchyma prevents the admission of air which would play an important role in the expulsion of mucus, pus or foreign material from the damaged bronchi through the medium of coughing. These bronchi, then, are inert receptacles which will retain and which will not expell infection and its byproducts without help. They are truly the "cesspools of the lungs."

It is to be expected that bronchiectasis should be a progressive disease. In an involved lobe the retention of infection produces further destruction of and damage to the tissues of the bronchi and lung parenchyma. With increasing fibrosis and rigidity of

the bronchial walls and lung parenchyma, drainage by means of coughing is still further impaired. Unless measures are taken to prevent it, the constant presence of infected secretions overflowing into adjoining bronchi, or being coughed into distant bronchi, constitutes a menace to previously healthy and normal bronchi.

Etiology

Several theories have been put forth regarding the mechanism which produces ectasia of the bronchi. Barring congenital anomalies, all of them contain two factors in common with one another: infection plus interference with the normal mechanism of bronchial cleansing.

The "mechanical pressure of stagnant secretions" of Laennec implies bronchial obstruction, whether it be due to a foreign body, neoplasm, luetic or tuberculous stricture, or sticky mucoid secretions. Broncholiths, collections of detritis and the closure of bronchi due to pressure are also agents which contribute to the development of bronchiectasis in the presence of infection.

The theory of "nutritional changes in the bronchial wall" proposed by Andral suggests a malfunction of the cilia and impairment of resistance of the tissues to infection. More recent observations on the value of Vitamin A in the healing of bronchial ulcers lends some support to the idea that susceptible bronchi are unhealthy or lack normal metabolism.

Stokes writes of the paralysis of the circular muscle fibers of the bronchi with subsequent loss of ciliary action and atrophy of the musculature as an etiological factor.

Pulmonary fibrosis or "cirrhosis pulmonum" was a principal factor in the production of bronchiectasis according to Corrigan, although it was his belief that the enlargement of the bronchi occurred as a result of direct pulsion or traction upon the bronchi. It is equally logical to assume that the fibrotic lung interefers with the cough mechanism sufficiently to interfere with bronchial drainage. Indeed, we have repeatedly seen bronchiectasis develop in the region of a thickened and immobile pleura following chronic empyema.

We have been still further impressed with the importance of impairment of bronchial cleansing in the production of bronchiectasis in a group of over two hundred patients (to be reported in detail in another communication) who had suffered exposures to mustard gas in the last war of exposures of sufficient severity to cause chemical burns of the bronchial mucous membrane with destruction of the ciliated epithelium. We have had the opportunity to make bronchograms on all of these patients, some of them repeatedly over the past four years, and to bronchoscope

many of them, taking biopsies of the bronchial lining. All of the patients with proved exposure have developed a severe bronchitis characterized in the bronchograms by a roughening of the bronchial contours. A large majority of them are developing bronchiectasis. Several have asthmatic symptoms with the production of a marked pulmonary emphysema.

It is significant to note that those patients with impaired bronchial drainage as indicated by loss of ciliated epithelium from the biopsy specimens and roughening of the bronchial walls on bronchograms suffer as severe symptoms and disability as do those who show evidence of true sylindrical and saccular dilatations of the bronchi. It forms the basis for our contention that the dilatation per se is not so important a factor as the functional impairment in bronchiectasis.

Diagnosis

It is not within the scope of this paper to discuss in detail the diagnosis of bronchiectasis. The characteristic history, physical findings and laboratory data are well described in many text books.

We would like to emphasize, however, the importance of good bronchograms in proving the diagnosis. Since bronchiectasis may exist in isolated segments, a good distribution of oil must be obtained. It should be so introduced and the patient sufficiently anesthetized that it is possible to fill the bronchial tree without producing a cough which clouds the picture by blowing oil into the alveoli. The x-ray films must be sufficiently penetrated to show the iodized oil through the heart shadow and behind the diaphragm. The patient should be positioned so it is possible to identify each affected segment of each lobe.

Having tried all known methods of making bronchograms, the authors have found the "dribble method" as effective as any of the more complicated procedures, at the same time causing less discomfort to the patient and requiring a minimum of time. The procedure consists of simple seating the patient on a stool in front of a fluoroscope and dribbling two eyedropperfulls of one half per cent pontocaine through one nostril while the tongue is held extended and the patient breathes through his mouth. The solution is directed by tilting the patient laterally, first to the right and then to the left. Immediately following this, the warmed iodized oil is slowly instilled in the same fashion over the course previously anesthetized by the pontocaine. When fluoroscopy shows that the desired bronchi have been well filled, appropriate x-ray films are immediately made.

In our experience, if bronchiectasis is present it can usually be demonstrated at one sitting with the use of 20 cc. of iodized oil.

This is adequate to fill the lower lobe, middle lobe and lower branches of the upper lobe on the right, together with the entire lower lobe, lingula and a few other branches of the upper lobe on the left. At this original examination the right lung is filled first so that a right lateral film will demonstrate the lobar and segmental distribution of the oil without interference from shadows in the contralateral lung. It is much easier to identify the bronchi on the left from the ensuing postero-anterior film, at least adequately for the original diagnosis. When resection is contemplated, the bronchograms are readily repeated directing the oil into those branches not previously filled and making the appropriate films to demonstrate the segmental distribution of the bronchiectasis present.

We are beginning to believe that when some type of resection is anticipated from the start, it is perhaps best to fill one lung completely and obtain postero-anterior and straight lateral x-ray films, followed in a few days by this same procedure on the contralateral side. This gives us our best conception of the segmental distribution of pulmonary disease. Utilizing a procedure as simple as the "dribble method," requiring less than 15 minutes, there is no objection to this very effective two stage procedure.

Treatment

Medical treatment of bronchiectasis consists of a routine of mechanical aid to the cleansing of the bronchi, combined with appropriate chemotherapy, and general support. Postural drainage at *frequent* intervals is essential, supplemented by expectorants such as ammonium chloride, gr. LX, daily and a high fluid intake to keep the bronchi moist. Since the damaged bronchi are incapable of rejecting the coal tar by-products of smoke, the patient cannot indulge in smoking. Repeated bronchoscopic aspirations of secretions are useful in some advanced cases. The choice of sulfa drugs, penicillin or streptomycin depends upon the flora demonstrated in sputum cultures, but all are reserved for those periods during which the patient most greatly needs them. General resistance is maintained by assuring the patient a high red blood cell count and hemoglobin, high protein and adequate vitamin intake.

Surgical therapy consists of removing involved lobes or segments of lobes after complete mapping of the bronchial tree with bronchograms indicates that the disease process is limited to areas of not too great extent to be totally excised. The advent of segmental resection has enlarged the group of patients who may be permanently relieved of their disease by surgical means.

All forms of collapse therapy are to be condemned as dangerous

and ineffective, except the occasional use of a temporary phrenic nerve interruption to check hemoptysis.

SUMMARY

The enlargement of the bronchi is not the significant aspect of the disease called bronchiectasis. Of greater importance is the loss of the cleansing mechanism of the bronchi, leading to the retention of infection, mucus and foreign matter. Retention causes progression of the disease, toxic absorption, recurring pneumonitis and many other complications.

Treatment is directed especially towards *providing drainage constantly,* supplemented by chemotherapy and all supportive measures which will increase the resistance of the patient. Where resection of all involved lobes or segments of lung is feasible, it offers permanent cure of the disease.

RESUMEN

En ensanchamiento de los bronquios no es el aspecto significativo de la enfermedad llamada bronquiectasia. De mayor importancia es la pérdida del mecanismo de limpieza de los bronquios lo que conduce a la retención de la infección, del moco y de los cuerpos extraños. La retención produce el progreso de la enfermedad, la absorción tóxica, la neumonitis recidivante y muchas otras complicaciones.

El tratamiento se dirige especialmente hacia el fin de proporcionar canalización constantemente complementada con la quimioterapia y por todas las medidas auxiliares que aumenten la resistencia del enfermo. Cuando la resección de todos los lóbulos o segmentos del pulmón enfermos es practicable, esto significa una cura permanente de la enfermedad.

REFERENCES

Andral: *Medical Clinic.* Translated by D. Spillon, Philadelphia, 1843, Barrington and Haswell.

Corrigan, D. J.: *Dublin M. Sc.,* 13:266, 1838.

Stokes: *Disease of the Larynx and Windpipe,* Dublin, 1937, Hodges and Smith, College Green.

Laennec, R. T. H.: *Traite' de l' auscultation Medical,* Paris, ed. 2, 1826, J. A. Bronson and J. S. Chaude.

Jackson C. and Jackson, C. L.: "Bronchoscopical Observations on Postoperative Pulmonary Complications," *Ann. Surg.,* 97:516, April, 1933.

Discussion

RALPH ADAMS, M.D., F.C.C.P.
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The point made about fibrosis in the areas surrounding the dilated bronchi is a critically important one. I am afraid that in

the last year, more patients have been harmed by segmental resection than were helped by it. Up until the last year, I think the reverse was true and the reason is that too many surgeons have tried to become prima donnas and see how little bronchiectasis they can remove instead of how much. It is true that the segment can sometimes be taken as the pathological unit of the lung as it is the functional unit but from a surgical standpoint you must remember that the division as distinguished from the segment is usually the smallest acceptable resective unit.

The second point about cough sensitivity, is absolutely true. There is a simple test which you can make yourself if you will through your bronchoscope and see the exudate welling back and forth in the primary bronchus, patient not coughing, although scarcely anesthetized. If you put India ink into a patient's normal lower bronchus, in five minutes you will see definite progression of that ink upward. In the chronically diseased bronchus, you will not; we have carried it for as long as 15 minutes.

The third point which Dr. Carr indicated but did not stress, from a physiological point of view, is an observation from point of time. It can be stated axiomatically as it has been before, if a patient has bronchiectasis before he is 10, he will be dead before he is 40 for the reason that he indicated, the persistence of fibrotic tissue that might well have been removed in the beginning.

DAVID H. WATERMAN, M.D., F.C.C.P.
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I would like to mention a personal debt to Dr. Carr that I have always felt. In 1941 he showed me his method of introducing oil into the bronchial tree and emphasized the importance of stereos. I think all of us have come to the point where we use very few stereo x-rays at the present time routinely but certainly with a well built bronchial tree, a stereo is a beautiful sight to behold and the individual branches that are involved stand out so clearly that until you have seen one, you can't appreciate the value of a good bronchogram.

I would also like to mention that the point he made of filling all segments of the bronchial tree cannot be overemphasized because from a surgical standpoint, we want to know exactly which bronchi are involved, either to a greater or lesser extent, and which ones are negative. The negative information is just as important as the positive.

ALFRED GOLDMAN, M.D., F.C.C.P.
St. Louis, Missouri

I would like to ask whether bronchiectasis is a progressive disease. Has Dr. Carr ever actually watched dilatations in new portions of the lung that weren't there when he first saw the case. I am asking about chronic bronchiectasis.

JOHN S. HARTER, M.D., F.C.C.P.
Louisvill, Kentucky

I would like to ask Dr. Carr what the significance is and the cause of nodulation that sometimes is seen in bronchiectasis in cases that are rather progressive; they are going downhill, losing weight, etc.

Closing Remarks

Duane Carr, M.D., F.C.C.P., Memphis, Tennessee: We have tried all known methods of making bronchograms, even to the injection of oil directly by needle into the trachea and which we subsequently abhorred. We passed catheters, both bronchial catheters and intratracheal tubes, and in the adult or in the cooperative patient, we have found the most satisfactory method to be the simple dribble method. The medicine dropper is put just inside the nares, the tongue is held out and the patient is requested to breathe through the mouth and the tongue is held to prevent swallowing. About two droppers full of one-half per cent pontocaine with 10 drops of adrenalin mixture is instilled into the nostril with the patient tilted to one side, and then the same procedure with the patient tilted to the contralateral side. Then the warmed oil in the syringe with a rubber tip is used and the tip of the catheter is passed over the first hump of the nares. The oil is allowed to run back the pharynx with deep quiet breathing. Oil doesn't run by gravity in the upper lobes but it is drawn in these lobes by the respiratory act, and you can fill them perfectly well by simply tilting the patient and the lobe into which the oil is guided is controlled entirely by position of the patient.

The deep quiet breath means that if the patient is breathing quietly without making any rasping noise, the larynx is relaxed and open. The oil runs in freely. The oil is instilled at the rate of about 1 cc. for every two breaths. Then of course we have fluoroscoped the patient to see when we have an adequate filling or have filled the portion of the lung we most particularly desire.

You will never get oil pneumonia if you empty the oil out immediately after getting the bronchogram.

We make no attempt to fill the entire bronchial tree at one sitting. One of us had that done to him and the dyspnoeic effect was truly distressing, and consequently in our ordinary diagnostic screening of bronchograms, we fill both lowers, the right middle, the lower segment and both uppers at the first sitting. Now if we contemplate surgery from the start, we will fill one lung completely and make PA and lateral films and at a different sitting entirely fill the other lung and make PA and lateral films. The total procedure from anesthetization to the taking of the films takes not over 10 to 15 minutes. There is no valid objection to dividing it in that fashion.

Dr. Waterman is quite correct that when we make stereoscopic films, it is easy to identify all of your segments individually and in at least one instance we showed a persistent block of a peripheral bronchus by stereoscopic film that we never would have spotted on ordinary examination. I am in perfect agreement with what Dr. Adams said in not going overboard for segmental resections when the segment showed dilatation and there was damage in the adjacent segments of the bronchi. In regard to Dr. Goldman's question we have seen repeatedly, particularly in mustard gas cases, progression of bronchiectasis from one segment to another. In one case there had been sufficient bronchiectasis in spite of measures directed at treating it that death ensued.

Adenoma and Cylindroma of the Bronchus*

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The subject of bronchial adenoma and cylindroma remains a highly controversial one. Despite differences of opinion as to origin, nomenclature, pathology, malignancy or benignancy, and treatment much has been learned about these unusual tumors, mainly through the cooperative efforts of endoscopists, surgeons, and pathologists. The various series of cases reported in the literature have done much to make clinicians and pathologists aware of the specificity of these entities and to narrow the points of disagreement among those who work in the field of thoracic disease.

This paper consists of an analysis of 20 cases of adenoma and two of cylindroma that have been seen during the past 12 years. Table I summarizes the age, sex, symptoms, duration, roentgen findings, bronchoscopic findings, diagnosis, treatment and end results of these patients. Several are discussed in greater detail to emphasize important features of the symptomatology, bronchoscopic aspects, histopathology or treatment.

Representative Cases

Case 5: G.W. This patient, a 25 year old white male, developed pleurisy in 1933 for which aspiration of the chest and adhesive strapping were done. Studies for tuberculosis were negative and in the next six years frequent colds and fever were present during the winter months. In 1939 he had his first hemoptysis with repeated attacks occurring in the next three months. On physical examination the percussion note, fremitus and breath sounds were reduced over the entire left chest. Roentgen and lipiodol studies revealed a density of the entire left chest considered to be both atelectatic and inflammatory in nature. Bronchoscopic examination revealed a polypoid tumor arising from the left main bronchus proximal to the left upper lobe orifice. Biopsies were reported as diffuse small round cell carcinoma. A left pneumonectomy was done on August 1, 1939. The patient expired on the eighth postoperative day following the sudden development of tension pneumothorax.

Pathology: A study of the resected lung showed the tumor to be 15 mm. in diameter; it was attached to the wall of the main bronchus over an

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area measuring 5-10 mm. in diameter. The distal bronchi were filled with varying amounts of foul mucopus and blood. Microscopically the tumor was composed of "a disorderly, diffuse proliferation of small to medium sized faintly granular cells with deeply staining irregular nuclei. They are occasionally found in cord-like or alveolar arrangements." There were two spicules of bone also present, and at the base of the tumor there was invasion of the bronchial wall. The hilar nodes were negative for tumor (Figs. 1 and 2). The diagnosis was "Bronchogenic Carcinoma." The autopsy failed to reveal any evidence of distant metastases. The cause of death was acute empyema secondary to left bronchial fistula and acute fibrinous pericarditis.

Review of the biopsy and surgical specimen slides have resulted in changing this to a final diagnosis of adenoma of the bronchus. The uniformity of the cells with tendency to glandular pattern separated by their connective tissue stroma can be seen in the photomicrograph. In figure 2 invasion into the wall of the bronchus can be seen. Of significance is the proximity of tumor tissue to a large caliber vessel. Bone spicules are also seen but they are representative of adult and not neoplastic bone. In view of our present concepts of bronchial adenoma, this case can justly be classified as a typical adenoma.

Case 13: E.O. This patient is a 34 year old white female who had complained of bronchitis with cough and sputum for six years. She had attacks of pleurisy and two years before entering the hospital thoracotomy was done for empyema. Subsequently she had repeated attacks of cough and sputum with episodes of fever and hemoptysis. Physical findings revealed diminution of the percussion note and breath sounds over the entire left lung; roentgen films showed a marked pleural density

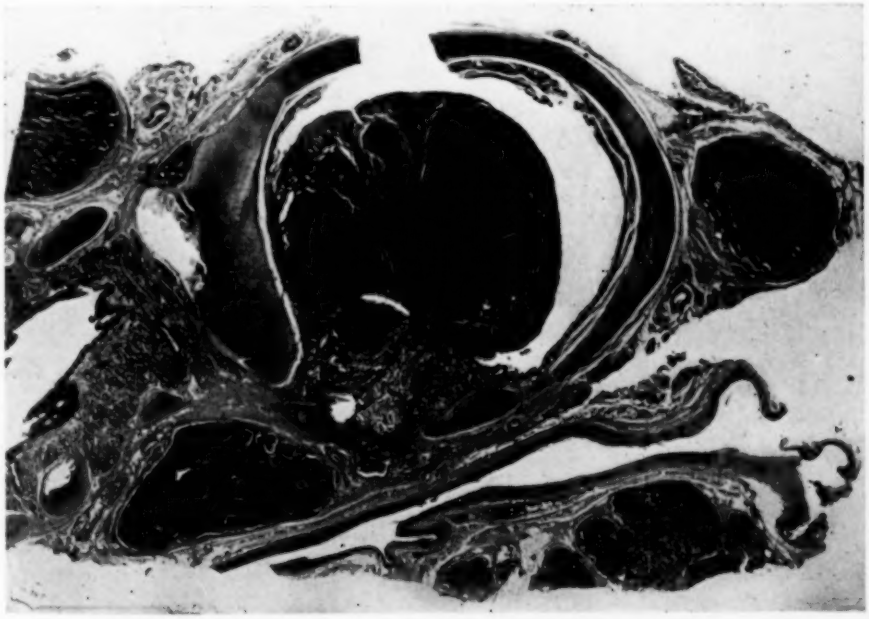

FIGURE 1, Case 5: (5X) Cross section of tumor in the left main bronchus. Note broad base of tumor and relation to cartilage, large vessel, and adjacent lymph nodes. No tumor present in the bronchial nodes.

TABLE I

Case		Age	Sex	Symptoms	Duration	Roentgen Findings	Bronchoscopy Findings	Histopathology	Treatment	Result	Final Diagnosis
1.	M.S.	50	F	Pneumonia 10 mos. ago, cough, sputum, hemoptysis	10 mos.	Density, left lower lobe	Obstruction, left lower lobe bronchus	Adenoma	Lobectomy, left lower lobe	Death - 3rd day, cardiac failure	Adenoma
2.	H.V.K.	36	F	Recurrent pneumonia with cough, sputum, hemoptysis	5 yrs.	Atelectasis, right lower lobe	Polypoid tumor right bronchus below middle lobe orifice	Small cell bronchogenic carcinoma	Right pneumonectomy	Well 7 yrs.	Adenoma
3.	G.L.	53	M	Cough, episodes of fever and hemoptysis	5 yrs.	Triangular density—left base posterior chest	Tumor obstructing lower lobe bronchus	Adenoma	Left lower lobectomy	Well 1½ yrs.	Adenoma
4.	C.B.	36	F	Recurrent pneumonia, cough, fever, hemoptysis	16 yrs.	Atelectasis, left lower lobe	Tumor obstructing left lower lobe bronchus	Carcinoma (1927) Adenoma (1936) Mixed tumor of bronchus (1941)	Pneumonectomy (1941)	Well 7 yrs.	Adenoma
5.	G.W.	25	M	Cough, sputum, hemoptysis	6 mos.	Density, left upper chest, partial aeration, left lower lobe	Tumor, left main bronchus, level of upper lobe orifice	Small round cell carcinoma (1938)	Pneumonectomy (1939)	Death 6 POD	Adenoma
6.	S.J.	63	F	Cough, chills, sweats	Many years	Atelectasis middle lobe	Tumor within middle lobe orifice	Carcinoma Adenoma	Pneumonectomy	Well 2 yrs.	Adenoma
7.	C.J.	31	M	Cough, episodes of streaked sputum	Several years	Atelectasis, left lower lobe	Obstruction, lower lobe bronchus	Adenoma	Left lower lobectomy	Well 2½ yrs.	Adenoma
8.	C.G.	49	F	Pneumonia Hemoptysis Cough	3 yrs. 3 yrs. 3 yrs.	Right upper lobe atelectasis	Obstruction, right upper lobe bronchus	Adenoma	Endoscopic Removal	Well 4½ yrs.	Adenoma
9.	L.S.	40	M	Cough, episodes of fever	10 yrs.	Atelectasis right upper lobe	Tumor mass obstructing right bronchus	Granulation tissue	Pneumonectomy	Well 2 yrs.	Adenoma
10.	E.S.	26	F	Wheeze, pneumonia, hemoptysis	3 yrs.	Atelectasis, right upper lobe	Tumor obstructing right main, originally from right upper lobe	Adenoma	Pneumonectomy	Well 4 yrs.	Adenoma

						lobe	originally from right upper lobe				
11.	C.H.	50	F	Cough, wheeze	2-3 yrs.	Atelectasis, left lung	Obstruction, left main bronchus, 1½ cm. beyond coryna	Adenoma	Pneumonectomy	Well 4 yrs.	Cylindroma
12.	L.M.	53	F	Cough, hemoptysis	1¼ yrs.	Atelectasis right lung	Tumor mass at coryna obstructing right main bronchus	Carcinoma Adenoma	Repeated bronchoscopy	Death 5½ yrs. Hemorrhage and asphyxia	Cylindroma
13.	E.O.	34	F	Cough, sputum pleurisy, empyema and hemoptysis	6 yrs.	Density, atelectasis, left lung	Obstruction, left main bronchus 1½ cm. beyond the coryna	Adenoma	Pneumonectomy attempted, thoracoplasty and cauterization	Well 5 yrs.	Adenoma
14.	R.H.	49	F	Cough, wheezing	1 yr.	Atelectasis right lower lung field	Pedunculated mass from right middle and lower lobe spur	Adenoma	Bronchoscopic removal 2x	Well 5 yrs.	Adenoma
15.	E.B.	35	F	Cough, hemoptysis	1 yr.	Atelectasis, left lower lobe	Obstruction, lower lobe bronchus	Adenoma	Bronchoscopic removal	Well 2½ yrs.	Adenoma
16.	R.H.	30	F	Cough, sputum, hemoptysis	6 mos.	Atelectasis, right lower lobe	Obstruction right lower lobe bronchus	Adenoma	Bronchoscopic removal 2x	Well 6 yrs.	Adenoma
17.	L.L.	32	M	Cough, sputum	3 mos.	Atelectasis, right upper lobe	Polypoid mass from right upper lobe	Adenoma	Repeated bronchoscopic removal 7x	Well 4½ yrs.	Adenoma
18.	J.K.	48	M	Cough, sputum, hemoptysis	5 yrs.	Atelectasis, right lower lobe	Obstruction, right lower lobe bronchus	Adenoma	Refused treatment	Living	Adenoma
19.	R.M.	34	F	Cough, sputum streaking	2 yrs.	Atelectasis, left upper lobe	Obstruction, left upper lobe orifice	Adenoma	Repeated bronchoscopy	Not seen 3 yrs.	Adenoma
20.	J.S.	50	F	Cough, hemoptysis	9 yrs.	Atelectasis, right lower lobe	Obstruction, right lower lobe	Adenoma	Bronchoscopy twice	Not seen 3 yrs.	Adenoma
21.	M.L.	34	F	Cough, sputum, hemoptysis	7 yrs.	Density, lower left chest	Obstruction left lower lobe	Adenoma	Repeated bronchoscopy	Improved	Adenoma
22.	T.M.	35	F	Cough hemoptysis	4 yrs.	Density, entire left lung	Left main bronchus	Adenoma	Repeated bronchoscopy	Improved	Adenoma

with little aerated lung on the left side. Bronchoscopy demonstrated a polypoid tumor in the left main bronchus which produced complete obstruction 1.5 centimeters distal to the coryna. Biopsy sections were interpreted as adenoma of the bronchus. Pneumonectomy was attempted in 1944 but was abandoned because of the complete obliteration of the pleural space by extremely dense fibrous tissue. A month later, thorocoplasty and cautery drainage of a large dilated bronchus was accomplished. The patient has a persistent bronchial fistula which drains purulent material, but she has no cough or hemoptysis unless the drainage tube becomes obstructed. She has been able to do all household tasks for the past three and one-half years. No further bronchoscopy has been done.

Pathology: Only biopsy specimens could be studied but large pieces of tissue were examined (Fig. 3). Microscopically the architecture was variable. At one extreme, well formed glandular structures separated by connective tissue trabecula were seen; while in other areas solid clusters of cells with only scattered septa were found. The cells were usually cuboidal to columnar with faint pink cytoplasm. The nuclei were round to oval with uniformly scattered fine chromatin material. No mitotic figures were seen.

The diagnosis in this patient is adenoma of the bronchus. She has had symptoms for 10 years but shows no evidence of any metastases from her primary tumor. Only biopsy specimens were obtained, and she obviously has residual tumor.

Case 6: S.J. This patient was a 63 year old nun who had been coughing for many years but particularly frequently during the past 10 weeks. Pain in the right chest, night sweats and anorexia were present, but at no time had she had hemoptysis. Roentgenograms revealed an atelec-

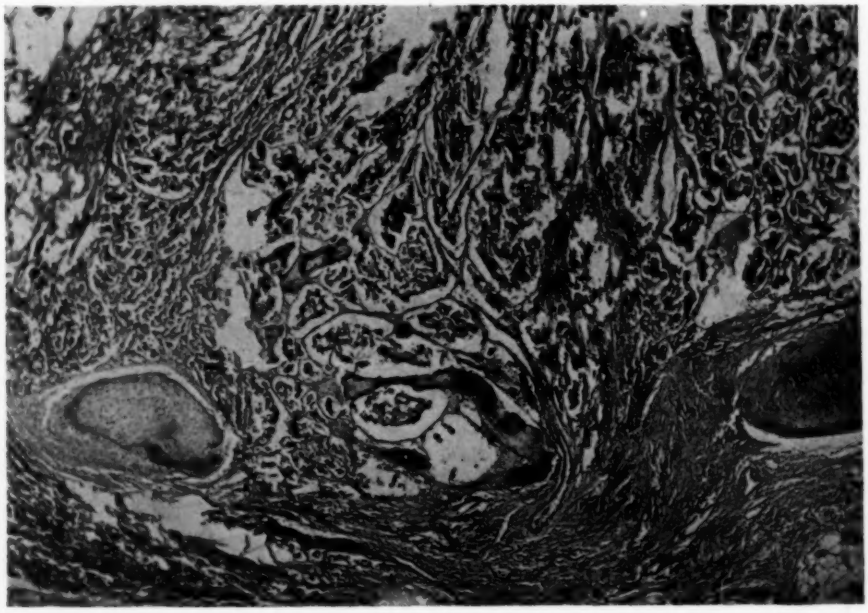

FIGURE 2, Case 5: (35X) Base of tumor. Note invasion of tumor into wall of the bronchus between the tips of the cartilage and the presence of a spicule of bone.

tatic shadow sharply outlining the right middle lobe. On bronchoscopic examination approximately 1 centimeter within the middle lobe orifice an obstruction was encountered from which tissue was obtained. The first diagnosis was carcinoma of the bronchus, and with that assumption, the right lung was removed in February 1946.

Pathology: The tumor nodule was within the middle lobe orifice; it was 6-7 mm. in diameter and attached over a mucosal surface of approximately 8 mm. The lung tissue distal to the tumor was atelectatic. Microscopically fine trabeculations of connective tissue separated clusters of cuboidal to columnar cells having eosinophilic cytoplasm and uniform vesicular nuclei. A glandular arrangement was frequently seen, but no secretion was apparent in the spaces. There was no evidence of extension beyond the cartilaginous plates or invasion into the nearby lymph nodes. Final diagnosis was adenoma of the bronchus. The patient is living and well with no evidence of metastasis or recurrence.

Case 3: G.L. This patient is a 53 year old white male who complained chiefly of cough of at least five years' duration. Two years previously he had an attack of pneumonia associated with pleural fluid which was aspirated at another hospital. Shortly thereafter his first hemoptysis occurred. He had spells of coughing, fever, and expectoration of large quantities of pus shortly before admission followed by more bleeding. Roentgenograms of the chest revealed an atelectatic shadow corresponding to the left lower lobe. On bronchoscopy a tumor was found located just below the orifice of the left upper lobe obstructing the lower lobe bronchus. The biopsy was reported as adenoma of the bronchus. The patient had a lobectomy in December of 1946, and has been well since with no further pulmonary symptoms.

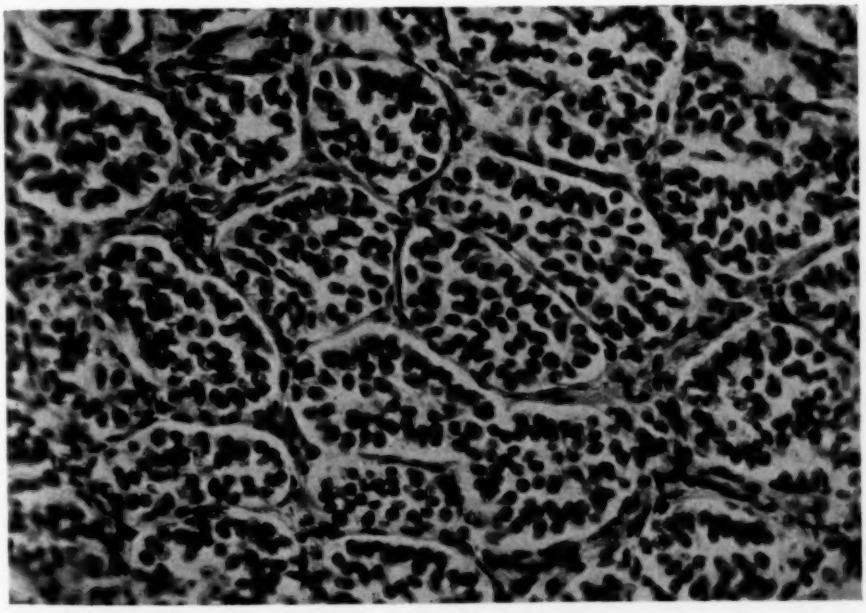

FIGURE 3, Case 13: (440X) Adenoma in which glandular structures are separated by thin collagenous tissue septa. Note cell and unclear uniformity, and the marked cellular hyperplasia which has resulted in the lumina being filled with cells.

Pathology: A flat fleshy tumor measuring 1.2 centimeters in diameter was found just distal to the site of amputation. It involved an area of bronchial wall 8 mm. in diameter, and the tumor extended through the wall in somewhat dumb-bell fashion so that a nodule of tumor measuring 6-8 mm. in diameter was present beyond the bronchus. The distal lung tissue was solid and airless with fibrous tags on the pleural surfaces and dilated bronchi containing purulent secretion within the parenchyma. No tumor metastases were present in the lymph nodes. The microscopic pattern was one of solid clumps of cells separated by thin connective tissue septa (Fig. 4). The individual cells were cuboidal with eosinophilic cytoplasm and vesicular round nuclei. Little or no tendency to glandular formation was apparent. The final diagnosis was adenoma of the bronchus. (Figure 4).

Case 14: R.H. This patient, a 49 year old white female, complained of cough of a year's duration and attacks of pleural pain. There was no previous hemoptysis. Roentgenograms had shown a density in the right lower lung. Because of a diagnosis of unresolved pneumonia, the patient had a bronchoscopic examination elsewhere which revealed a papillary tumor interpreted as adenoma. Bronchoscopy in 1942 revealed the tumor to be papillary in character and to originate at the entrance to the right lower lobe, immediately below the middle lobe orifice. The major portion of the tumor was removed with bronchoscopic forceps and by electrocoagulation and a small residual portion was removed similarly four months later. At least six subsequent examinations have been made and no tumor tissue has been found. The patient has been well, without symptoms for five years. Pathologic diagnosis was adenoma of the bronchus.

Pathology: The variation in the microscopic picture is seen in figure

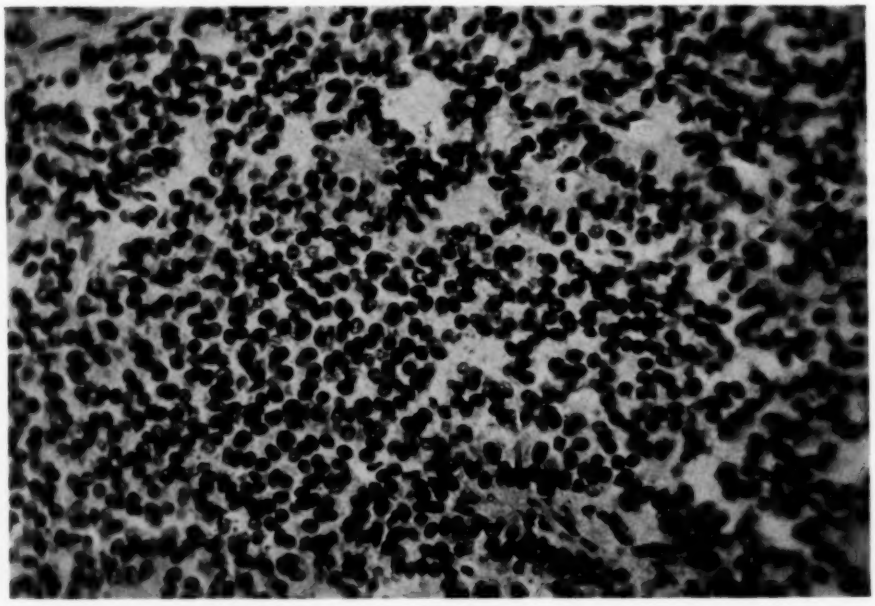

FIGURE 4, Case 3: (440X) Adenoma consisting of occasional acini but for the most part diffuse sheets of cells which still retain uniformity. Nuclei little and mitotic figures absent.

5 under 110× magnification. On one side an anastomosing network of cells is found separated by connective tissue of varying dimensions often containing thin walled vessels. At the other margin, the cells are found scattered or in clusters. Glandular pattern is not well demonstrated. The individual cells, however, were cuboidal, eosinophilic and with little variation as to size, shape or staining. Although there is little tendency to form glands, the final histopathologic diagnosis is adenoma of the bronchus. It is made on the character of the individual cells. This variation in the microscopic picture in biopsy or surgical specimens is not uncommon, and careful study of the individual cells is of importance in establishing the final diagnosis (Fig. 6).

Case 11: C.H. This patient, a 50 year old white female, had symptoms of cough for five years, particularly severe in the past three to four months. The dyspnea was characterized by inability to completely force out air, and there had been some wheezing at times. Bronchoscopic examination revealed a round tumor occluding the left main bronchus, lying 1.5 cm. below the bifurcation of the trachea. A biopsy was interpreted as adenoma of the bronchus and in July, 1944 her left lung was removed. The tumor had infiltrated the wall of the bronchus making it friable, and as a result the bronchus tore during the procedure. A segment was removed above the line of defect and closure effected. The convalescence was uneventful and the patient remained symptom free for four years. In June, 1948 she was examined again because of gradually progressive dyspnea and a sudden change in voice. The left vocal cord was found to be paralyzed, the trachea compressed and the coryna markedly distorted. Irregular tissue removed from the entrance of the stump of the left main bronchus showed tissue similar to that found on the first bronchoscopic examination.

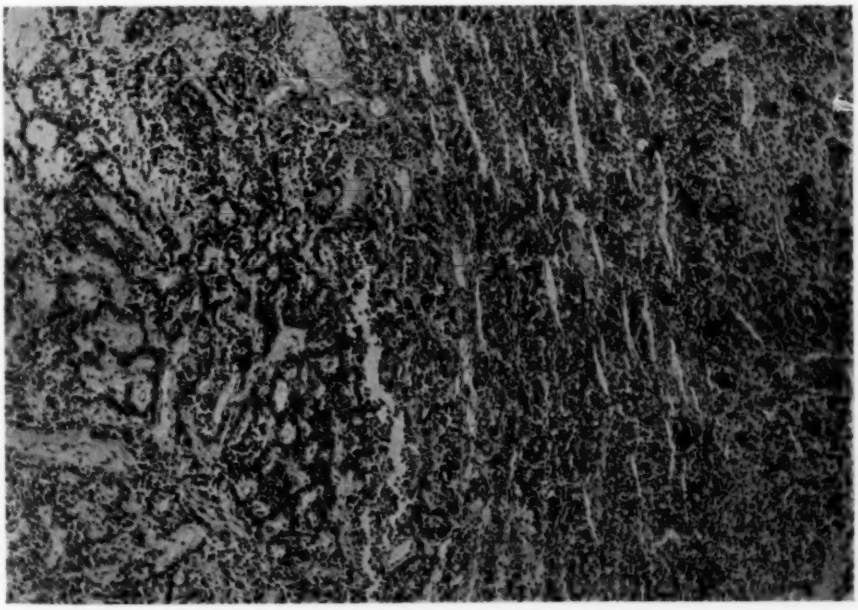

FIGURE 5, Case 14: (110X) Adenoma consisting of anastomosing cords of cells forming false acini at one margin and solid sheets and clusters of cells in an adjacent area.

Pathology: Study of the resected lung showed that the segment of bronchus above the point of accidental rupture contained tumor tissue along 1.2 cm. of its 2.8 cm. length. The neoplasm elevated the bronchial mucosa for a distance of 8 mm. and involved all but 2 mm. of the circumference. The bronchus attached to the lung contained tumor extending into several of the smaller branches. The bronchi of the upper lobe were dilated and contained mucopus, and the parenchyma was firm and atelectatic. The lower lobe bronchi were slightly dilated. Microscopically the tumor was composed of clusters of epithelial cells in a rather dense stroma with little evidence of vascularity. There was great tendency to form glands of several layers' thickness and many of these contained pink or purple secretion. Frequently several glands were present in a cluster of cells, and in other instances the cell groups were solid. These clusters were seen to invade into the tissues beyond the cartilaginous plates. The individual cells were variable from columnar to cuboidal and the nuclei varied in size, shape and staining. The final diagnosis in this specimen was cylindroma of the bronchus (Fig. 7).

Case 12: L.M. This patient was a 53 year old white female who complained of episodes of hemoptysis for 10 months and cough for four months. X-ray film of the chest demonstrated a partial atelectasis of the right lung. On bronchoscopic examination in January, 1941 a tumor was found partially filling the right main bronchus and extending to the coryna. A biopsy specimen was reported as bronchogenic adenocarcinoma.

Because of the extent of the tumor to involve the coryna, surgical removal was considered impossible, and the subsequent course of treatment was repeated bronchoscopic removal of tumor to maintain an airway into the right lung. Between these procedures the patient's

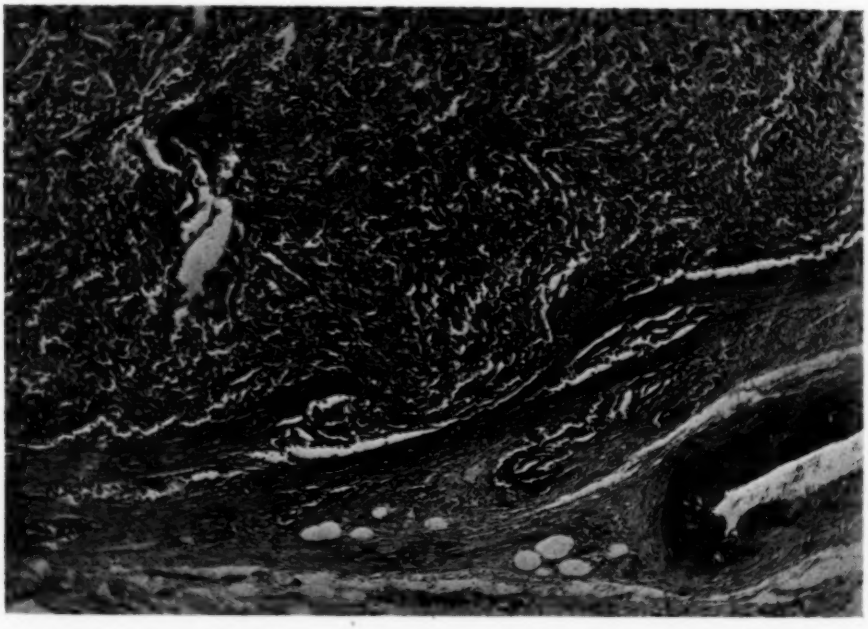

FIGURE 6, Case 1: (110X) Adenoma revealing characteristic acinar architecture but demonstrating clusters of cells invading adjacent collagenous tissue.

clinical course was punctuated by episodes of hemorrhage and dyspnea. Eventually, after five years, the tumor grew into the trachea and serial chest x-rays showed nodular densities appearing in the left lung with gradual development of a complete atelectasis of the right. Because of the slow course of what was supposed to be a bronchogenic carcinoma, the biopsy specimens were reviewed. There was a variation of opinion among pathologists as to whether the lesion was an adenoma, a cylindroma, or a bronchogenic adeno-carcinoma. The patient finally expired due to a massive hemorrhage and asphyxia. This was five and one-half years after the tumor had been discovered.

Pathology: At necropsy, there was complete atelectasis of the right lung with deviation of the mediastinum to the right side. The collapsed lung contained firm gray tumor which bulged into the trachea from the normal bronchial site, invaded the hilar lymph nodes and involved roughly 75 per cent of the lung parenchyma. At the periphery were six to eight solitary metastases, and in the opposite lung were more than a dozen discrete masses of tumor ranging from a few millimeters to centimeters in diameter. The left main bronchus contained a large amount of freshly clotted blood which was the cause of her sudden asphyxia. Metastatic lesions were seen in the kidney.

Microscopically the tumor was composed of varying sized clusters of cells either solid or forming one or more glandular spaces (Fig. 8A). In some areas the stroma was largely replaced by broad sheets of cells with many glandular spaces containing pink or purple mucinous material while in others the thin stromal tissues formed branching networks around the cell groups. The individual cells were variable in size and usually contained only a small amount of cytoplasm. The nuclei were generally deep staining, occupied almost all of the cell space, and varied

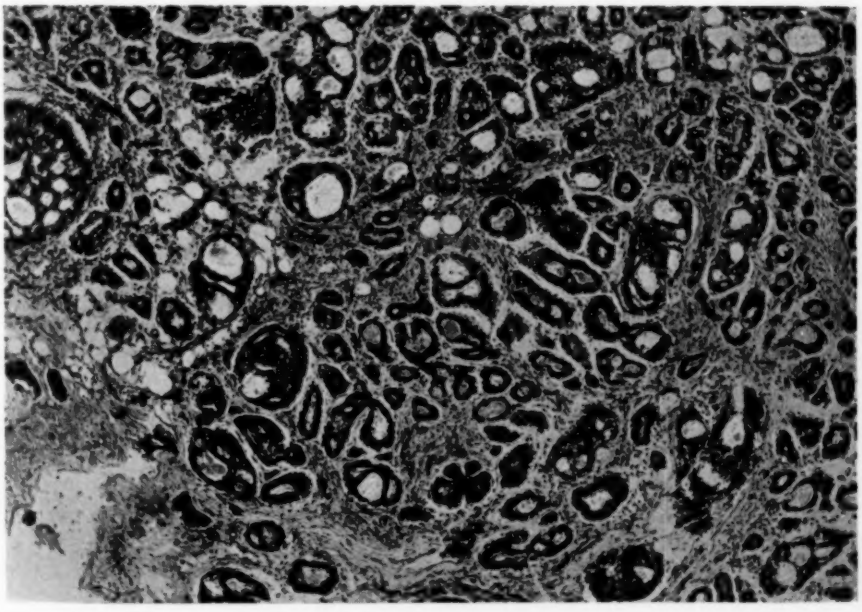

FIGURE 7, Case 11: (110X) Cylindroma. The stroma is more dense and the acini are likened to "cylinders" frequently containing secretion and often having multi-layered cell walls.

in size and shape. Mitotic figures could be seen but only very occasionally. The microscopic appearance of the metastatic foci was the same as the primary. The final diagnosis was cylindroma of the bronchus with metastases of hilar lymph nodes, contralateral lung and kidney (Fig. 8B).

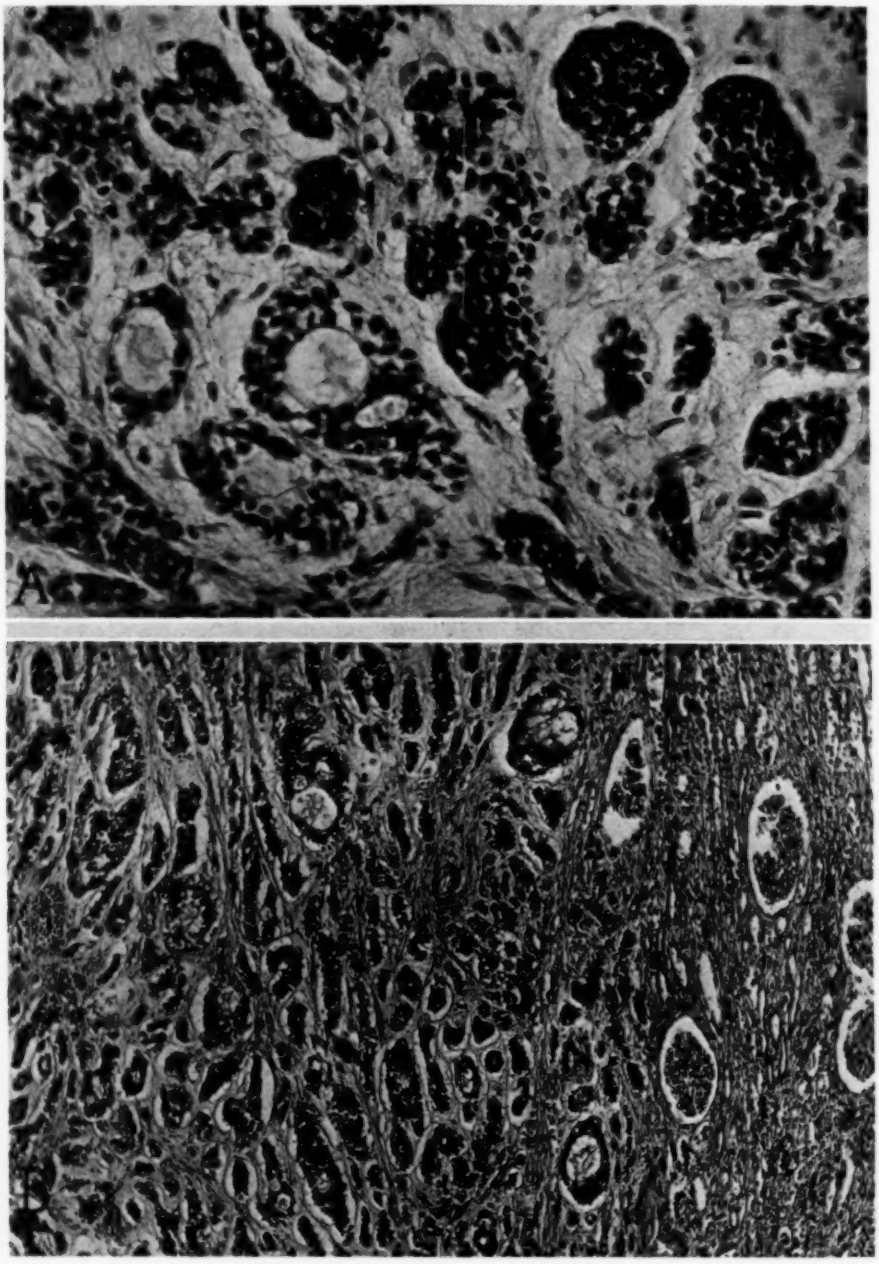

FIGURE 8A, Case 12: (440X) Cylindroma in which acini are single or multilayered or solid masses of cells. Note presence of secretion in many glandular spaces.—FIGURE 8B, Case 12: (110X) Kidney with cylindroma metastasis reduplicating histologic picture of primary lesion, Figure 8A.

Discussions

Origin: A brief review of Table 1 reveals that in every patient in this group, the neoplasm was found in a major bronchus. This same feature has been mentioned in most of the reported cases,[1-3] although, Maier and Fischer[4] reported five cases of adenoma in each of which the tumor was found in a small branch bronchus and gave none of the usual symptoms of pulmonary suppuration. It is of interest to note that microscopic lesions strongly suggestive of adenoma have been seen in two of our patients not reported in this series. One of these lesions was found accidentally in a right lower lobe removed for bronchiectasis, the other in a lung removed at autopsy in an individual who died of arteriosclerotic heart disease. In each case, the lesion was remote from a large bronchus.

Heretofore, the origin of these tumors was considered by most physicians to be from the glands of the main large bronchi. On the other hand, Stout[5] and Hamperl[6] believe that adenomas arise from special cells called onkocytes. These can be seen best by special staining techniques and are found in the bronchial mucosa, and serous and mucinous glands. Womack and Graham,[7,8] Harris[9] and Albertini[10] propose the theory of origin from embryonal bronchial buds. Harris studied serial sections of human embryos and further stresses the importance of the similarity between the haphazard arrangement of bronchial glandular elements in the embryos to the picture seen in adenomas. These authors also emphasize the frequency with which other tissues such as cartilage, bone, muscle, and fat occur in adenomas and believe this fact to be additional support of the theory that they derive their origin from embryonic bronchial buds.

From the studies of the cases in our series, we believe that the origin is most likely from either the serous or mucinous glands of the main bronchi.

Nomenclature: Many different names have been proposed in the various series reported in the literature. Among them are "mixed tumors of the bronchus," "malignant adenoma of the bronchus," "benign glandular tumor of the bronchus," "carcinoid of the bronchus," "basal cell carcinoma of the bronchus," etc. Although "mixed tumor" is used because of the presence of other tissues, bone was seen in only two of our cases (No. 4 and No. 5) (Fig. 2). In these two cases the bone was not neoplastic tissue but developed as a result of metaplastic changes secondary to long standing infection. Case No. 4 in our series had a total pneumonectomy elsewhere; this case was reported by Mallory.[11] We agree with his interpretation that the presence of the bone tissue

in the tumor may be due to metaplasia associated with long standing pulmonary infection.

"Malignant adenoma" is almost a paradoxical term. Adams, Steiner and Block[12] have advocated it because in their series of five patients metastases were found in four. "Carcinoid" has been proposed since the tumor has a resemblance to the peculiar argentaffin tumor of the appendix. However, almost all cases fail to show silver granules. In one of the cases in Holley's[13] series, silver staining granules were found in biopsy tissue. No special staining technique was carried out in our material.

The term "basal cell" tumor of the bronchus is proposed because of the resemblance to certain skin tumors known as *epithelioma adenoides cysticum* which is considered a variety of basal cell carcinoma of the skin. This term seems more fitting because of the clinical characteristics rather than the actual histopathologic picture.

Lastly, Moersch, Tinney and McDonald[14,15] have divided these tumors into the adenoma and cylindroma groups, stressing distinct differences as to histology and clinical course. This division is a rational one. "Adenoma of the bronchus" immediately suggests a specific type of bronchial tumor; although differences of opinion regarding many phases of this clinical entity do exist, these differences are becoming narrower. The cylindroma is a distinct variant with clinical as well as pathological criteria that make it a separate entity.

Symptomatology: Tables II through IV summarize the main clinical features of adenomas and cylindromas as they occurred in the cases of this series. A greater incidence in the female, with occurrence most frequently in the 30 to 40 year age group, and

TABLE II
SEX DISTRIBUTION

	Male	Female
Adenoma	6	14
Cylindroma	0	2

TABLE III
AGE DISTRIBUTION

	20-30 yrs.	30-40 yrs.	40-50 yrs.	50-60 yrs.	60 & over
Adenoma	2	10	4	3	1
Cylindroma	0	0	0	2	0

with hemoptysis occurring in at least 80 per cent of the patients is well in accord with other reports. It is worthwhile to correlate the pathologic changes with the symptoms most frequently found.

First, the prominent symptom of hemoptysis appears to be the result of the actual tumor architecture and blood supply. The photomicrographs readily reveal the small thin wall vessels that course between the glandular and cord-like elements. Trauma from coughing can easily disrupt the continuity of vessel walls with resulting hemoptysis. The other symptoms which develop

TABLE IV
INCIDENCE OF HEMOPTYSIS

	Present	Absent
Adenoma	15	5
Cylindroma	1	1

TABLE V
SUMMARY OF TREATMENT AND END RESULTS

ADENOMA:		
Bronchoscopy,		
Biopsy only	1	
Complete removal. Living and well. Symptom free	5	
Partial Removal,		
Improved	4	
Died	0	
Surgical Resection,		
Pneumonectomy,		
Living and well	4	
Improved	1	
Died	1	
Lobectomy,		
Living and well	1	
Improved	1	
Died	1	
Others,		
Improved	1**	
Total Cases		20
CYLINDROMA:		
Bronchoscopy,		
Partial Removal,		
Died	1	
Pneumonectomy,		
Improved	1*	
Total Cases		2

*Case 11: Recent evidence of recurrence.
**Case 13: Thoracotomy only. Tumor still present.

are related to the mechanical factors caused by bronchial obstruction. As the tumor grows into the lumen the passage of air currents over it is altered producing the wheeze so characteristic of the early stage of the symptoms. With more pronounced and finally complete obstruction, air exchange stops and the lung distal to the tumor becomes atelectatic. Varying degrees of bronchopulmonary suppuration may follow, leading to bronchiectasis or abscess or extension beyond the lung to involve the pleural space. Marked pleural reaction was present in four of the cases operated.

Pathology: From the standpoint of gross pathology, the smooth, rounded, red appearance of the lesion seen bronchoscopically is quite characteristic and needs no further comment. Of the 10 patients operated, it was possible to study the surgical specimens in seven, the others having had their surgery elsewhere. Of the five surgical specimens which we have classified as adenoma, all had broad points of attachment such as described in cases No. 3 and No. 5. Occasionally there was extension of tumor through the wall in dumb-bell shape fashion. The gross and microscopic features of the two cases classified as cylindroma have already been described (Cases No. 11 and No. 12, Figs. 7 and 8).

From biopsy or surgical specimens, this series may be divided into two groups. Twenty cases were considered as adenoma and two as cylindroma. In reviewing the adenoma specimens, it was at once apparent that variation in the microscopic picture did exist. Moreover, in large biopsy specimens, variations were seen in the same slide. Figures 2 and 3 are both adenomas, yet Figure 2 demonstrates the lumina of the acinar spaces to be filled with cells. In another area of this particular specimen, solid sheets of cells were present with little or no dividing stroma. Figure 3 is a classical example of what is currently being accepted as an adenoma. Yet Figure 4 again demonstrates the diffuse cellular character which may be seen. In this patient, the tumor extended in a dumb-bell manner through the wall of the bronchus. Figure 5 is taken from Case No. 14. At this low power we again have an example of variation in the architecture in the same field. Of the five specimens obtained by pulmonary resection which allowed examination of the entire tumor, invasion by small clusters of cells into the deeper tissues of the bronchus was seen in four. Figure 6 under low power (Case No. 1) demonstrates this very well.

Only two cases in this series are classified as cylindroma (see abstracted cases 11 and 12). Microscopically the invasion was evident as clusters of tumor cells were found invading freely between the plates of bronchial cartilage. Figure 7 is a photomicrograph from the surgical specimen of case No. 12. Figure 8A and B are from the primary tumor in the lung and metastases

to the kidney respectively of the same case. This histologic pattern is accurately reproduced in the latter.

Despite the variation in the architectural arrangement of the *adenoma* group, the individual cells are very similar. Briefly, these cells are cuboidal to columnar, have a faint eosinophilic granular cytoplasm and round to oval nuclei. The chromatin network is usually fine and scattered. Mitoses are extremely rare. Even in those adenomas in which glandular spaces are almost totally lacking, it is difficult to find mitotic figures.

The *cylindroma* type, however, has a different type of cell and many times it is difficult to make out individual cell borders. The nuclei are more variable and the chromatin is more dense and stains more deeply. When a glandular pattern is observed in the adenoma group, seldom, if ever, is secretion found while in the cylindroma type a pink to purple mucin-like material can be seen. Comparison of the photomicrographs reveals the differences mentioned.

From the standpoint of pathology, it is valid to divide these tumors into the two types, since the cylindroma is an active, invading tumor in contradistinction to the adenoma. In one of the cylindromas distant metastases were observed. However, while tumors in the adenoma group also demonstrate small invading clusters of cells, distant metastases could not be demonstrated. In the two patients who came to necropsy, the *invasive* feature of the true adenoma is undeniable (See Figures 1 and 6).

Thus, the fundamental question may be raised as to whether these tumors should be considered benign or malignant. It is not necessary that the presence of metastases be a criterion of malignancy. For example, gliomas of the central nervous system do not metastasize but rightfully are considered malignant. Basal cell carcinomas of the skin are malignant tumors yet metastasis is uncommon. It is interesting that original diagnosis in early cases of various series reported was frequently bronchogenic carcinoma. The fact that the clinical course was so unlike bronchogenic carcinoma eventually led to re-evaluation, and accordingly the diagnosis was changed to adenoma. Likewise, in our series the diagnosis in early cases was carcinoma. The re-evaluation has led to the correct interpretation.

More recently, further classification is developing. Some writers in reviewing cases have realized that some classified as adenoma were different enough histologically as well as clinically. Holley[13] divides the two into a carcinoid and mixed tumor type. We prefer to use the adenoma and cylindroma terms similar to the terminology suggested by Moersch, Tinney and McDonald.[14,15] The cases herein presented give further support that this distinction

is necessary since the cylindroma type is unquestionably a more invasive tumor.

From the foregoing study and discussion of the cases herein presented, two statements may be made. First, these bronchial tumors represent a group entirely separate from bronchogenic carcinoma both from a pathologic and clinical standpoint. Second, it is further possible and desirable to subdivide the group and to recognize an adenoma and cylindroma type.

Treatment and Results

The therapeutic procedures available to the endoscopist or surgeon are numerous. Endoscopically the tumor may be resected by forceps removal or may be coagulated with the electrocoagulating bronchoscope.[16] Large tumors obstructing major bronchi may be removed in massive sections through a coring technic[17] of advancing the entire bronchoscope through the lesion into tumor-free bronchus beyond. This may be followed by electrocoagulation of residual tumor tags. The appreciable danger[18] associated with such bronchoscopic procedures is the hemorrhage due to the well known vascularity of adenomas. It has been suggested that if bronchoscopic means of removal are to be used the tumor first be injected with a sclerosing agent or radon seeds to reduce the possibility of this complication.

The therapeutic procedures available to the surgeon are primarily lobectomy and pneumonectomy. Segmental lobectomy may be considered, but generally the tumor involves a bronchus leading to at least a whole lobe if not the entire lung. Bronchotomy with removal of a tumor with a section of the bronchus has been described for certain benign tumors, and this might be considered in rare cases of adenomas. Such a technic is valueless if the lung distal to the tumor is sufficiently involved in a suppurative process to necessitate its removal. It becomes necessary to employ other procedures discussed below at times when surgical exploration makes it apparent that lobectomy or pneumonectomy is not surgically feasible.

With the numerous bronchoscopic and surgical procedures available the following factors influence the choice of therapy: Immediate radical excision (pneumonectomy) is advocated if the tumor proves to be a cylindroma type. A variation of approach may be considered if the tumor proves to be adenomatous in character.

In this series of cases, bleeding associated with cautious forceps removal of tissue for biopsy became one of the criteria which determined whether further attempts to remove tissue would be made bronchoscopically or whether this method would be aban-

doned immediately. Repeated attempts at endoscopic removal of a freely bleeding tumor will ultimately result in fatal hemorrhage. In only one case in this series radon seeds were injected into the tumor in an attempt to reduce hemorrhage prior to endoscopic removal. The procedure did not appear to influence bleeding.

The position of the tumor will in itself be an important factor influencing the choice of therapy. Upper lobe lesions as a rule cannot be completely removed through the bronchoscope because of their anatomically inaccessible position, unless, as occurred in one case in this series, the tumor lies in the orifice of an upper lobe bronchus. Tumors originating in the main bronchi or the lower lobe bronchi are easily accessible bronchoscopically and the re-establishment of bronchial continuity is therefore feasible and practical by this technic.

Another factor influencing the choice of therapy is the condition of the lung distal to the obstruction. If extensive pulmonary suppuration and irreversible parenchymal change have taken place which would of themselves necessitate a lobectomy or pneumonectomy, endoscopic attempts to remove the tumor are obviously of value only to enhance drainage prior to surgery.

Finally, the continuation of bronchoscopic tumor removal is dependent on the results being obtained. If the bronchus can be cleared by simple endoscopic removal during two or three sessions and checked from time to time, radical surgery hardly seems necessary. However, if there are rather regular recurrences, extirpation of the lobe or the lung is advocated.

Table V summarizes the treatment employed in this series. Of the 20 adenomas, 10 have been treated by bronchoscopic removal alone and 10 by external surgical approach. Of the 10 bronchoscopically treated patients, one had a biopsy only. (This patient is the only one in the series not traceable). Five of the 10 are living and well, symptom free and with no evidence of residual tumor. Four are living and improved, with residual tumor but for the most part asymptomatic. There have been no deaths in this group.

Ten cases were treated surgically: seven by pneumonectomy and three by lobectomy. Of the seven pneumonectomies four are living and well. One operated elsewhere is improved but with surgical complications remaining. One is improved following attempted pneumonectomy, although it was not surgically feasible to remove all the tumor. One postoperative death following pneumonectomy was due to sudden development of tension pneumothorax and empyema. This case is discussed in detail above. Of the three lobectomies, one is living and well with no residual tumor. One is improved although the tumor was incompletely

removed. This patient was operated elsewhere and it was the decision of the surgeon to do only a lobectomy rather than remove the entire lung due to circumstances at the time of the surgery. The third lobectomy died postoperatively due to cardiac failure.

The two cylindromas in this series were treated by opposite extremes of therapeutic possibilities. This was due not to a desire to test either therapeutic procedure but to the factors inherent in the tumors themselves. In the first patient, the tumor was considered surgically inoperable at the time the diagnosis was first established because of the invasion from the right bronchus into the trachea. This patient lived five and one-half years because of frequent bronchoscopic removal of tumor tissue. The second patient had a total pneumonectomy and remained well for four and one-half years without further therapy. Recently she developed dyspnea and hoarseness, and examination has shown a paralysis of the left vocal cord and extensive mediastinal metastases with recurrence of the tumor in the bronchial stump.

The results of treatment of this series correspond with those of other reports. Both bronchoscopic and surgical measures were available and were used according to the indications and contraindications discussed.

SUMMARY

Twenty cases of adenoma and two of cylindroma of the bronchus are presented and analyzed according to their history and clinical, x-ray and bronchoscopic findings. The histopathology is discussed to emphasize the differentiation between adenomas and cylindromas. The adenomas are considered as extremely slowly growing but invasive tumors, rather than metastasizing malignant neoplasms, whereas cylindromas meet all the criteria of malignant lesions.

Choice of therapy was influenced by the location and histologic character of the lesion, the presence or absence of bronchopulmonary changes peripheral to the lesion, the degree of hemorrhage associated with the bronchoscopic procedures, and the response to endobronchial therapy. Of the 20 cases of adenoma, 10 were treated by bronchoscopy alone and 10 by subsequent surgical procedures. Of the former group (bronchoscopic), complete removal was effected in 5, of whom 4 are improved, and 1 was seen for biopsy only and has not been traceable. Of the latter group (surgical), total pneumonectomy was performed in six cases; four are living and well, one improved, and one died postoperatively. Lobectomy was performed in three cases; one is living and well, one improved, and one died postoperatively. The 10th surgically

treated patient merely had a thoracotomy with cautery drainage, resection being impossible due to extensive adhesions. In the cylindroma group, one patient was treated bronchoscopically for 5½ years merely to keep the tracheal and bronchial airway open since the tumor had involved the entire right bronchus and invaded the trachea at the time of diagnosis. The second patient in this group was treated by immediate pneumonectomy but had a recurrence 5½ years later.

RESUMEN

Se presentan veinte casos de adenoma y dos de cilindroma bronquial y se analizan de acuerdo con su historia clínica, los rayos X y los hallazgos broncoscópicos. Se discute la histopatología para hacer resaltar la diferencia entre cilindromas y adenomas. Los adenomas son considerados como tumores extremadamente lentos para crecer, pero invasores más bien malignos y metastatizantes en tanto que los cilindromas reúnen todas las características de neoplasias malignas.

La elección de tratamiento fue influída por la ubicación y el carácter histológico, la presencia o ausencia de cambios broncopulmonares distales a la neoformación, el grado de hemorragia consecutivo a la broncoscopía y la respuesta al tratamiento endobronquial. De los 20 casos de adenoma, 10 fueron tratados por broncoscopía y 10 por subsecuentes procedimientos quirúrgicos. Del primer grupo (broncoscópico), se logró extirpación completa en 5, de los que 4 han mejorado y uno solo fue visto para biopsia y ahora se ha perdido de vista. Del segundo grupo (quirúrgico) se hizo neumonectomía total en 6 casos; cuatro están vivos y bien, uno mejorado y uno murió en el postoperatorio. Se hizo lobectomía en tres casos; uno está vivo y bien, uno mejoró y uno murió en el postoperatorio.

Al décimo caso, tratado quirúrgicamente, solamente se le hizo toracotomía con drenaje al cauterio, pues la resección fue imposible debido a adherencias muy extensas. En el grupo de cilindromas, un enfermo fue tratado por cinco años con broncoscopía solamente para mantener abierto el paso de aire a traquea y bronquios, puesto que el tumor había invadido completamente el bronquio derecho y la traquea cuando se hizo el diagnóstico. El segundo enfermo de este grupo fue tratado con neumonectomía inmediata, pero tuvo una recurrencia a los cinco y medio años más tarde.

REFERENCES

1 Brunn, Harold and Goldman, Alfred: *Surg., Gyn., Obst.*, 71:703, 1940.

2 Jackson, C. L. and Konzelman, F.W.: "So-Called Adenoma," *Ann. Otol., Rhin. and Laryng.*, 50:126, 1941.

3 Goldman, A. and Stephens, H. B.: "Polypoid Bronchial Tumors with Special Reference to Bronchial Adenomas," *J. Thor. Surg.*, 10:327, 1941.

4 Maier, Herbert C. and Fischer, Walter W.: "Adenomas Arising from Small Bronchi not Visible Bronchoscopically," *J. Thor. Surg.*, 16:392, 1947.

5 Stout, A. P.: "Cellular Origin of Bronchial Adenoma," *Arch. Path.*, 35:803, 1943.

6 Hamperl, H.: "Uber gutartige Bronchialtumoren (Cylindrome und Carcinoide)," *Virchow's Arch. f. path. Anat.*, 300:46, 1937.

7 Womack, N. A. and Graham, E. A.: "Mixed Tumors of the Lung, So-Called Bronchial or Pulmonary Adenomas," *Arch. Path.*, 26:165, 1938.

8 Graham, E. A. and Womack, N. A.: "The Problem of the So-Called Bronchial Adenoma," *J. Thor. Surg.*, 14:106, 1945.

9 Harris, W. H.: "Histologic Analogy of Bronchial Adenoma to Late Prenatal and Early Postnatal Structures," *Arch. Path.*, 35:85, 1943.

10 Albertini, A. von: *Schweiz. f. Path. & Bakt.*, Vol. VIII, 1945.

11 Mallory, T. B.: "Case Records of the Massachusetts General Hospital; Case 27511," *New England J. Med.*, 225:983, 1941.

12 Adams, W. E., Steiner, P. E. and Block, R. G.: "Malignant Adenoma of the Lung, Carcinoma-Like Tumors with Long Clinical Course," *Surgery*, 11:503, 1942.

13 Holley, Sion W.: "Bronchial Adenomas," *Military Surg.*, 99:528, 1946.

14 Moersch, H. J., Tinney, W. S. and McDonald, J. R.: "Adenoma of the Bronchus," *Surg., Gyn., Obst.*, 81:551, 1945.

15 McDonald, J. R., Moersch, H. J. and Tinney, W.S.: "Cylindroma of the Bronchus," *J. Thor. Surg.*, 14:445, 1945.

16 Jackson, C. L., Konzelmann, F. W. and Norris, C. M.: "Bronchial Adenoma," *J. Thor. Surg.*, 14:98, 1945.

17 Clerf, L. H. and Bucher, C. J.: "Adenoma (Mixed Tumor) of Bronchus: A Study of 35 Cases," *Ann. Otol., Rhin. and Laryn.*, 51:836, 1942.

18 Nager, F. R.: "Zur Klinik des Bronchialadenoms," *Practica Oto-Rhino-Laryngologica*, 7:97, 1945.

Discussion

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I was glad to read in the abstract of Dr. Holinger's paper that the emphasis was put on pathology, because I believe that the crux of the confusion in this subject of benign adenoma and similar tumors lies in the pathology; the necessity for sorting out several different types, at least these two; particularly differentiating the adenoma from the cylindroma. That is a step in the right direction, taken by Van Hazel, Holinger and Jensik. I had the privilege of hearing a most interesting discussion at the Thoracic Surgeons' meeting in Quebec recently; papers by Goldman of San Francisco and Neuhof and Rabin of New York, and then a lot of discussion. Neuhof and Rabin presented 65 cases and they made a particular point of restricting their list to adenoma cases, and stated that they were leaving out cylindromas, mixed tumors and several others that they mentioned. In the discussion they were criticized for leaving out these cases,

by some who do not recognize the differential histopathologic diagnosis.

It has been our contention that the typical adenoma has no inherent tendency to become malignant. We do not say that none become malignant. We of course insist that the low grade character of the malignant cylindromas is important in deciding what treatment should be given. We have been increasingly impressed with the importance of taking into consideration the extrabronchial portion of the growth, as Dr. Holinger has well demonstrated in some of his sections. This is important, not so much from the point of view of further extension or metastasis, but because of bronchial compression by the extra-bronchial portion of the growth. There is one fact that stands out clearly in our minds, namely, that these cases should be individualized as to treatment. They should not be automatically subjected to lung resection as a carcinoma should.

We presented a report of 20 cases of adenoma in 1944 at a meeting of the Thoracic Surgeons, subsequently published in the Journal of Thoracic Surgery in April, 1945. Since then we have had 11 cases. Of the first 20, three were treated surgically, two by lobectomy and one by pneumonectomy; 17 were treated bronchoscopically. Of the 11 recent cases, three were treated by surgery and eight bronchoscopically. Thus there were 31 cases, seven treated surgically and 23 bronchoscopically.

Closing Remarks

Robert J. Jensik, M.D., Chicago, Illinois: We hope to add something to unequivocally establish these lesions as definite entities. I was pleased to see that the first two photomicrographs shown by Dr. Jackson were classified as cylindromas, because we feel strongly on that point, that this type must be separated from the adenomas. We are not original in this observation because others, including the Rochester group, have emphasized this differentiation.

We believe that the cylindroma types are certainly more invasive, and as you saw in one case in our series, there were definite distant metastases. Reviewing the histopathology, it is important to stress that cylindromas practically all have some evidence of secretion in the glandular forms that are present; whereas in the adenoma types we seldom see that. In adenomas we may see piling up of cells and obliteration of glandular pattern, but there is not criteria enough to say that malignant degeneration has occurred. In one of our cases the course has been at least eight years and yet there is no evidence of any distant metastasis and the patient is living and well.

As to whether they are benign or malignant, I think we might avoid that issue by saying that we should consider even adenomas invasive but with nowhere near the invasive tendency of cylindromas. We believe that since distant metastases are so uncommon in the adenomas one is not justified in saying the tumors must be considered benign. After all, such tumors as gliomas occurring in the central nervous system, or basal cell tumors of the skin, are considered malignant, yet metastases are rare.

Biochemical Studies in Cancer Diagnosis*

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In 1944 Savignac et al[1] reported that serum samples from patients with malignant disease exhibited a decreased ability to reduce methylene blue solutions. Using a technique which varied somewhat from that of Savignac, my own studies appeared to corroborate the essential validity of his observation.[2,3] This paper will deal with studies of the reducing power of plasma as well as investigations on the heat sensitivity of plasma of patients with and without malignant disease.

The reducing power is measured by the ability of a plasma sample to decolorize a standard amount of methylene blue. The exact procedure consists in mixing 1 cc. of plasma with 0.2 cc. of 0.15 per cent aqueous solution of methylene blue in a Wasserman tube. The tube is then immersed in a boiling water bath until complete decolorization of the dye has occurred. In a study of more than 1,000 plasma samples from presumably healthy individuals, a characteristic distribution curve was obtained, the peak of which lies between 8 and 8.5 minutes. The upper limit of the curve is found at 10.5 minutes. This is at variance with similar studies of plasma samples from individuals with a wide variety of malignant disease. Here the reducing time values are more prolonged, and in some cases it may require more than 20 minutes to bring about complete reduction of the dye. This may be seen by the percentage of cases having reducing time values of 11 minutes or more, viz., carcinoma of the breast 40 per cent; carcinoma of the lung 73 per cent; carcinoma of the cervix 59 per cent; carcinoma of the colon 68 per cent.

Since there is a decided overlap of values in the time range of 9.0 minutes to 10.5 minutes, a second reducing power technique is employed when such time values are encountered. This procedure employs a 0.1 per cent brilliant cresyl blue in place of the methylene blue. After a 10-minute immersion in the boiling water bath, the tube is removed, cooled, and the color noted. In general, two main types of reactions are found: (1) complete reduction of the dye, resulting in a greyish-white coagulum, and (2) incomplete reduction of the dye, leaving a lavender-colored coagulum.

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The former reaction is obtained in testing plasma samples from healthy individuals, while the latter is found in a majority of patients with malignant neoplasia. In analyzing the reducing power values obtained by these techniques, it was assumed that all methylene blue reducing times of 8.5 minutes or less were normal values. All reducing times of 11.0 minutes were abnormally high, while reducing times falling between 9.0 minutes and 10.5 minutes were evaluated on the basis of the brilliant cresyl blue reaction. An incomplete brilliant cresyl blue reduction in such cases was considered to be evidence of a decreased reducing power, while a complete reduction was indicative of a reducing power within normal limits. The use of these criteria indicated a decreased reducing power in approximately 75 per cent of a series of 600 cases of diverse forms of malignant neoplasia, while no such decrease in reducing power was found in approximately 2,000 samples from healthy individuals. Most common diseases and benign tumors gave reactions similar to the control group. This was not the case in samples of tuberculosis, rheumatic fever, cirrhosis, and in gravid females. This would indicate that the alterations in reducing power, while seemingly associated with the presence of malignancy, is not specific for it.

The relation between the presence of a malignant growth and a decreased reducing power may also be observed by following patients who have received therapy, since the fluctuations in the reducing power in such patients is particularly interesting from the prognostic standpoint, as it provides an objective means of following the effects of the therapeutic procedure. Thus, variations have been seen after adequate therapy both in carcinoma and sarcoma wherein the therapy was radiation or surgery. It may be said, therefore, that while some cancer cases may exhibit normal plasma reducing times although they still harbor foci of malignant neoplasia, the persistence of an elevated reducing time is extremely strong evidence that all such foci have not been eradicated.

The mechanism of this change in reducing power in association with the presence of malignant neoplasia appears to be part of a systemic effect on protein metabolism. The previous studies by Savignac et al appeared to implicate the albumin fraction as the principal plasma component responsible for the reduction of the dye. My studies suggest that the -SH group of a protein component of the plasma, most probably albumin, is responsible for the reducing power as measured by the technique described.

In an attempt to evaluate the sulfhydryl group and the reduction of methylene blue, a study was undertaken with various compounds of known -SH and -S-S- structures.[4] Glutathione,

cysteine hydrochloride, and methionine were made up in equimolar solutions (0.0325 M) in distilled water. One cc. of the glutathione solution was added to 0.2 cc. of 0.13 per cent methylene blue solution. In a similar manner, the dye was added to 1 cc. samples of the cysteine and methionine solutions. The tubes were then immersed in a boiling water bath and observed for time of complete decolorization. The tube containing methionine and methylene blue failed to show any change in color in spite of continued boiling for one and a half hours. On the other hand, complete decolorization was noted in the tubes containing cysteine HC1 and glutathione in 6.0 and 15 minutes respectively. The reduction of methylene blue by cysteine and glutathione and not by methionine is an indication that in these compounds at least a free -SH bond is required. The more prolonged time for glutathione (15 minutes) as compared with cysteine HC1 (6 minutes) would seem to indicate that the availability or reactivity of the -SH bond may be altered by its location in the molecule. Thus, in cysteine the -SH is terminal and presumably unhindered in its activity. In the case of the glutathione, the internal location of the -SH bond seems to decrease its reactivity. The reversible decrease in the reducing power of plasma associated with malignant neoplastic disease might be explained on the basis of changes in the spatial configuration of the albumin molecule. Such changes would be readily reversible and would not necessitate changes in amount of total proteins or -SH bonds. This is of importance since the observed decrease in reducing power is not correlated with changes in the concentration of the plasma proteins. Thus it appears that the reduction of methylene blue by plasma in the technique described is a measure of the reactivity or appearance of the reducing groups rather than a measure of the total number of such groups potentially available.[5]

While the presence of malignant disease is associated with a deficiency in albumin fabrication as evidenced by a lowering of the reducing power and often times a lowering of the serum albumin, the fibrinogen concentration tends to undergo elevation. This finding, reported by various investigators and corroborated in our own studies, indicates that the various protein components of the plasma are influenced differently by the presence of malignant disease. The exact significance of this difference is not clear, but it should be remembered that while albumin production appears to be a function of the liver parenchyma, this is not so for fibrinogen which more probably arises in the reticuloendothelial system.

When plasma samples from individuals with and without malignant disease were exposed to a standard amount of heat, it

was noted that the former group tended to show a greater degree of turbidity.[6] The procedure employed is as follows: (1) 1 cc. of plasma is placed in a Klett colorimeter tube and diluted to the 5 cc. mark; (2) a reading of the light transmission is taken in the colorimeter; (3) the tube is immersed in a boiling water bath for exactly 10 seconds; (4) after cooling and drying the tube, a second reading of the light transmission is taken.

The difference between the first and second readings is a measure of the coagulation or turbidity production and has been termed the coagulation value. When the values of plasma samples from healthy individuals were plotted, a peak was found at a value of 48, while less than 2 per cent of the cases extend beyond 82.

This was quite at variance with the results obtained when plasma samples of cancer patients were tested, since more than 60 per cent of the cases were found to have coagulation values of 80 or above. In view of the small percentages of controls with coagulation values above 79, it was arbitrarily decided to adopt a coagulation value of 80 or above as suggestive of the presence of malignant neoplasia. In a series of 199 cases of diverse cancer types, the mean of the coagulation values was 99.

It should be mentioned that the coagulation values obtained will vary somewhat when different colorimeters are used. Therefore, it is advisable for each laboratory to establish the normal limits for its own machine. When this is done, the values obtained with the plasma of cancer patients will show the same type of variation as reported here.

In a similar study of plasma samples from patients with non-neoplastic disease, it was found that while most of the common diseases did not cause alterations in the coagulation values, rheumatic fever, tuberculosis, and pregnancy yielded reactions which in some cases were indistinguishable from those of cancer patients. These findings indicate that the specificity of these studies is not absolute, a fact of extreme importance in the application of these findings to clinical problems.

In general, it may be said that benign tumors gave reactions similar to the control group.

As with the reducing time studies, adequate therapeutic procedures were followed by a return to normal of the coagulation values of cancer patients. These variations are well illustrated in a case of Hodgkins Disease that underwent several remissions and exacerbations. Fluctuations from values of 155 to 45 occurred as the patient went from an active state to one of clinical remission. With a recurrence of activity, the coagulation value rose from 172, only to fall to 55 as another remission was induced.

Chemical investigation of the basis of these changes indicated

that it is related to the fibrinogen concentration. Thus, similar heating of serum samples failed to induce a turbidity, and parallel determinations of fibrinogen and coagulation values revealed a correlation between the two. Since individual cases were encountered wherein the fibrinogen concentrations were the same but wide divergencies were noted in the coagulation values, it would appear that some other factor or factors are involved in addition to the fibrinogen concentration.

The use of the reducing power and coagulation techniques in combination revealed that the diagnostic accuracy could be greatly increased. Thus, cancer was considered to be present when a positive reaction was obtained with either or both tests. By the use of these criteria, cancer was identified in approximately 87 per cent of a series of 194 cancer cases of diverse types. Eighty-five per cent of the cases were identified by the use of the methylene blue and coagulation techniques without recourse to the brilliant cresyl blue procedure. Examples of the diagnostic accuracy in various common types of malignant growths may be found in the accompanying table. Here the diagnostic accuracy of the reducing power technique is compared with that obtained by utilizing both procedures.

It will be evident that while plasma samples from cancer patients do not always give malignant reactions with both the coagulation and reducing power studies, in most cases one or the other was positive. The high degree of accuracy in the identification of plasma samples from cancer patients warrants further

DIAGNOSTIC ACCURACY

	REDUCING POWER		COMBINED METHOD	
CANCER	Cases	Per cent	Cases	Per cent
Breast	61	66	34	89
Cervix	46	87	15	94
Colon	44	82	13	93
Fundus	21	62	12	88
Hodgkins	21	91	12	88
Lung	38	90	14	93
Lymphosarcoma	22	82	10	70
Prostate	14	93	4	100
Rectum	18	100	9	100
Sarcoma	15	87	6	100
Stomach	40	88	10	90

study of these tests of their value as a screening method for cancer. It should be emphasized, however, that similar reactions were also obtained in certain non-neoplastic conditions, and that approximately 10 per cent of the cancer patients tested were not identified by these methods. It is therefore important that these data should not be used indiscriminately. It is only with due regard for its limitations that it may be applied as an aid in the diagnosis and follow-up of cancer cases.

Finally, it should be pointed out that these observations add to the growing data on the systemic alterations in the tumor host and strengthen the concept that cancer is a systemic disease whose local manifestations may vary but whose presence is associated with a surprising uniformity of body milieu.

REFERENCES

1 Savignac, R. J., Grant, J. C. and Sizer, I. W.: "Reducing Properties of Serum from Nonmalignant Patients and from Normal Individuals," *A.A.A.S. Research Conference on Cancer,* 1944, p. 241.

2 Black, M.M.: "Changes in the Reducing Power of Serum or Plasma of Patients with Malignant Neoplastic Disease," *Cancer Research,* 7:321, 1947.

3 Black, M.M.: "Changes in the Reducing Power of Plasma in Patients with Malignant Neoplasia and Therapeutic Implications," *Thirty-Eighth Annual Meeting, American Association for Cancer Research, Inc.,* Chicago, Illinois, May 1947.

4 Black, M. M.: "Sulfhydryl Reduction of Methylene Blue in Reference to Alteration in Neoplastic Disease," *Cancer Research,* 7:592, 1947.

5 Black, M. M.: "Plasma Reduction of Methylene Blue," *Science,* 108:540, 1948.

6 Black, M.M., Kleiner, I. S. and Bolker, H.: "Changes in Heat Coagulation of Plasma from Cancer Patients," *Cancer Research,* 8:79, 1948.

Discussion

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At the Methodist Hospital in Brooklyn we have done about 400 of the reducing power tests, but none of the coagulation studies. In this discussion only the malignancies proved by autopsy, biopsy or operation will be presented, as Dr. Black has already given the controls on the normals.

In our group of malignancies we had 47 positive tests; of these, 41 were different types of carcinoma; 5 were lymphomas such as Hodgkins' disease and lymphosarcoma; and one was an acute leukemia. We had 15 negative tests in later proved malignancies. As in Dr. Black's series, we had a high percentage of cancer of the breast with five negative tests. There were five of the digestive

system; two pancreas, one stomach, and two of the colon. Of the lungs we had two negative tests, of the uterus one, of the ovary one and of bone one. This gives us a false negative percentage of 24 per cent.

In our entire group of positive tests there were 47 carcinomas. We also had the non-neoplastic conditions which we know will give a positive reaction that we can eliminate, such as newborns, 13, 100 per cent positive; penicillin therapy, 7; low plasma protein, 4 (below 5); and the last trimester of pregnancy, 3. Of the unknown positives we have 18.

To sum up the positive tests, give us carcinoma, 47; non-neoplastic conditions which we eliminated in the calculations, 27; and unknown causes, 18. This is a 73 per cent accuracy, which is fairly close to Dr. Black's 79 per cent.

In a breakdown of the false positives we had three cases of pernicious anemia with one death and no autopsy; two with fever of undetermined origin, accompanied with weight loss and still undiagnosed; three with gastrointestinal defects shown by x-ray, two of whom refused surgery; two cases of vaginal bleeding with negative biopsy; one case of ulcerative colitis; one case of thyrotoxicosis and two cases with symptoms of spinal cord pressure. Incidentally, one of these last-named has since been diagnosed as carcinoma of the prostate with metastasis. There was one case of anuresis in an eight year old child. This boy was given a thorough examination from every conceivable angle and no malignancy was found, though he had a consistently positive test. One case of myocardial infarct was not thoroughly investigated because of his serious condition. One gastric ulcer and one case of appendicitis also had positive tests.

Thus, we have done 400 tests for diagnostic purposes and have found 27 per cent false positives and 24 per cent false negatives. The test is 75 to 80 per cent accurate and we believe it worth while.

Closing Remarks

Maurice M. Black, M.D., Brooklyn, New York: There are some additional points that I might make: In addition to Dr. Morris' repetition of the work, I have also received other reports from various parts of the country. While as yet no series comparable to my own has been accumulated, more than 500 cases have been done in various laboratories, and I think it is fair to say that in general the results are quite similar to my report today. I concur in the instances of false positive results that Dr. Morris has pointed out. These are pregnancy, tuberculosis, active rheumatic fever, and marked hypoproteinemia. Similar false values may also be obtained in patients who are receiving penicillin treatment.

In general, these sources of error may usually be eliminated in the differential diagnosis. While additional study and confirmation are greatly to be desired, the techniques of the test are simple, and if the dyes are correctly calibrated and normal distribution curves established, there appears to be no reason why it cannot be used to advantage.

Acute Fatal Asphyxia Due to Aortic Aneurysm in Patient with Four Saccular Aneurysms of Thoracic Aorta: Case Report*

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Acute asphyxiation as the cause of death in patients with aneurysm of the thoracic aorta is rare. Ficarra,[1] in reporting a case with chronic compression of the trachea and right lung by an aneurysm of the ascending aorta, with death attributed to asphyxia resulting from chronic ischemic and anoxic anoxia, stated that "clinical and pathological literature on aneurysms fail to report any instance of asphyxia due to aortic aneurysms." Pernet[2] reported an instance of mechanical asphyxia due to gigantic aneurysm. No other reference to acute asphyxiation has been encountered, although it is well known that mechanical pressure on the trachea and resultant respiratory difficulties are common in aneurysm of the thoracic aorta.

Compression of the trachea by aortic aneurysm is most apt to occur when the aneurysm is situated in the transverse portion of the arch. Lucke and Rea[3] found compression of the trachea by two of 23 aneurysms at the junction of the ascending and transverse arch, and by five of 46 aneurysms of the transverse arch. Keefer and Mallory[4] state that tracheal compression usually results from pressure by aneurysm of the transverse arch or of the innominate artery.

In cases of aneurysm of the ascending or transverse arch, Kampmeier[5] found dyspnea to occur in 65 per cent and to be due most often to tracheal, bronchial, or pulmonary compression. Boyd[6] found dyspnea reported as the first or chief complaint in 31 per cent of cases of aneurysm of the thoracic aorta, and that more severe and steadily increasing dyspnea resulted from pressure on the trachea or large bronchi. Several authors[5-7] refer to a paroxysmal type of dyspnea, of unknown causation, but rarely seen in the absence of pressure on the trachea or large bronchi. Changes in posture may precipitate a feeling of suffocation.

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Kampmeier[5] noted respiratory stridor in 11.7 per cent, and "choking spells" in 7.3 per cent of 205 patients with aneurysm of the transverse arch; such findings were much less frequent in cases with aneurysm of the ascending or descending arch. Of 247 patients with thoracic aortic aneurysm who died, he found 46 (18 per cent) died of respiratory obstruction. Keefer and Mallory[4] mention that gradual suffocation may result from retention of tracheal and bronchial secretions. None of these writers makes mention of acute asphyxiation, as was dramatically observed in the case to be described.

The occurrence of multiple saccular aneurysms of the thoracic aorta is not infrequent, but the precise incidence cannot be determined from the data in the literature. Paullin and Minnich[8] state that multiple aneurysms are fairly frequent, there being one fairly large saccular dilatation accompanied by many smaller ones. Wilburne and Taylor[9] reported two patients who had three and one patient who had four aneurysms of the thoracic aorta. Lucke and Rea[10] in a study of 268 necropsied cases with aneurysm, found multiple aneurysms (chiefly of the aorta, but occasionally an aortic aneurysm associated with aneurysm of one of the aortic branches) in 53 (19.7 per cent). In a more detailed study,[3] but where the data given do not permit exact analysis, they indicate that at least one patient had three or more aneurysms. The figures of Colt,[11] which may be weighted because they were based in large part on published case reports, reveal an incidence of 57 cases (10 per cent) of multiple aneurysms among 575 patients with thoracic saccular aortic aneurysm, two aneurysms being present in 43 cases, three in seven, four aneurysms in four, and more than four in three patients. Kampmeier[5] found 23 cases (3.6 per cent) with two or more sacs among 633 patients with aneurysm of the thoracic aorta, and at autopsy found five cases with two sacs and three with three aneurysms.

According to Stokes and associates,[12] small sacculations and finger aneurysms result from localized bulging at spots weakened by fibrosis due to inflammatory changes around the vasa vasorum. In cases of aneurysm, the systolic blood pressure tends to be low and the diastolic high. An intact aortic valve, by permitting a constant and even pressure on the aortic wall, favors the production of aneurysmal dilatation, while the development of aortic regurgitation tends to protect against the formation of aneurysm. Kampmeier[5] states that hypertension, in the absence of aortic insufficiency, may aggravate the tendency to saccular dilatation.

The present report describes a patient who died of acute asphyxia when an aortic aneurysm suddenly occluded the tracheal

lumen. This occlusion was observed bronchoscopically, yet at necropsy the tracheal lumen, though narrowed, was not occluded, suggesting that the tracheal obstruction during life was due to dynamic dilatation of the aneurysmal sac. An incidental finding was the presence of three smaller aneurysms of the thoracic aorta.

CASE REPORT

A 56 year old farmer entered the Veterans Administration Hospital, Aspinwall, Pennsylvania, on the evening of August 6, 1947. He complained of dyspnea of one year's duration, most intense in the last three months, associated with progressively severe hoarseness of six months' duration and a marked cough. He slept on two pillows and had experienced several episodes of nocturnal paroxysmal dyspnea. His weight had declined from 135 lbs. to 110 lbs. There was no chest or back pain, and no edema or palpitation. Syphilis was denied by name and symptoms.

On examination, the patient revealed evidence of recent weight loss. He was slightly dyspneic and orthopneic at rest and extremely hoarse. His cough was of metallic, rasping quality. The neck veins were slightly distended. The pupils were irregular and unequal, but reacted to light. The fundi could not be examined. The trachea lay in the midline. The point of maximum cardiac impulse was felt in the sixth interspace within the midclavicular line. Dullness to percussion extended beyond the sternum in the left second interspace. Grade IV systolic and diastolic, high pitched aortic murmurs were heard over the entire precordium. A Duroziez murmur and pistol shot sound were heard over the femoral artery. Marked capillary pulsation was present in the nail beds. The blood pressure was 120/40. No pulsus alternans or gallop rhythm was present. The lungs were hyperresonant and coarse bronchial rales were heard bilaterally. The liver extended one fingerbreadth below the costal margin but was nontender. The peripheral vessels appeared thickened and tortuous. The knee jerks and ankle jerks could not be elicited. No penile scar was apparent. There was no edema.

Laboratory Data: The blood Kahn and Wassermann tests were positive. The blood count revealed 3,190,000 red blood cells and 18,400 white blood cells per cu. mm. (neutrophils 84 per cent, lymphocytes 16 per cent); hemoglobin 10 gm. per 100 cc. The urine contained a faint trace of albumin, frequent white blood cells, one to two red blood cells per h.p.f., and rare granular casts; the specific gravity was 1.021.

On the day following admission, while drinking through a straw, the patient suddenly gagged or choked. Following this, he became extremely cyanotic, but the pulse remained of good volume at a rate of 80 per minute. There was suprasternal retraction, and the patient was using his accessory muscles of respiration. The breath sounds were markedly depressed in all lung fields. The initial clinical impression was tracheal obstruction. An endotracheal tube was inserted, and suction yielded considerable quantities of clear mucus without foreign material. The vocal cords appeared grossly normal. One hundred per cent oxygen was administered by mask with slight decrease in cyanosis. The blood pressure was 240/69. The endotracheal tube remained in situ for approximately one-half hour during which time the patient appeared somewhat less dyspneic. After removal of the tube, intensification of the cyanosis ensued. Questioning of the patient at this point revealed that he had

experienced one previous similar episode. A chest x-ray film showed cardiac enlargement, and dilatation of the aorta compatible with aneurysm. The respiratory obstruction progressed relentlessly as evidenced by increasing sternal retraction and the use of all accessory muscles of respiration. The patient appeared to be in extremis, and emergency bronchoscopic examination was performed. The trachea was seen to be markedly deviated to the right and almost completely occluded at its lower end by an extrinsic pulsating mass, believed to be an aneurysm. Marked pulsation of the aorta was transmitted to the bronchoscope. The patient became semicomatose and remained so until his demise three hours after the onset of the acute episode. No morphine had been administered.

Necropsy Findings: The necropsy was performed five hours after death. The relevant findings were as follows: The pupils were round, but unequal, the right measuring three mm., the left four mm. in diameter. The trachea appeared slightly deviated to the right on palpation. The skull and its contents appeared normal. Both lungs were wet, the left weighing 550 gm., the right 600 gm. The left lower and right upper lobes presented irregular purplish-red areas of doughy consistency. There was no evidence of foreign matter in the tracheobronchial tree.

The heart was hypertrophied, weighing 500 gm. The left ventricular wall measured 20-22 mm. in thickness, the right five mm. The aortic valve revealed slight cord-like thickening of the free edge of the posterior cusp, the commissures being widened to two mm. The valve circumferences were as follows: T.V. 13 cm., P.V. 7 cm., M.V. 10 cm., A.V. 8 cm.

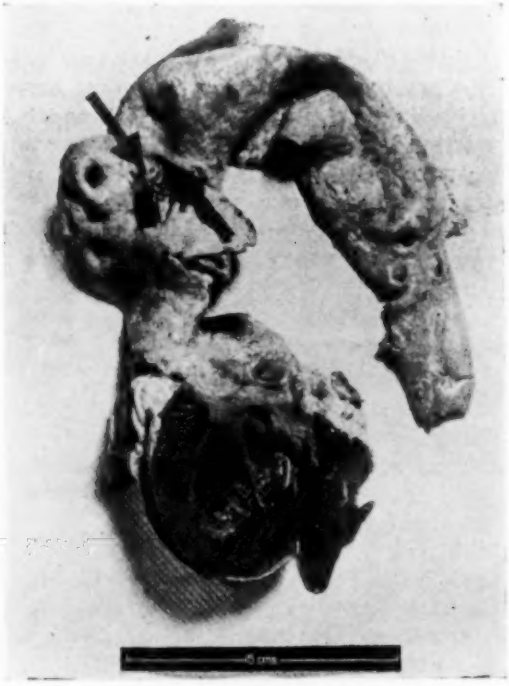

FIGURE 1: The aneurysm impinging on the trachea lies opposite the origin of the great vessels. The arrow on the right lies in the opening of a second sac. The other arrow points to the tiny third sac. The fourth aneurysm lies to the right of the upper arrow.

Thickened, puckered intima of the sinuses of Valsalva produced moderate narrowing of the coronary ostia. The branches of the coronary arteries were widely patent, however; the left anterior descending branch showed a few small, yellow intimal plaques.

The thoracic aorta was thickened, inelastic, and widened, measuring 8 cm. in diameter in its ascending portion. The intima of the aorta down to the level of the renal artery was roughened by innumerable flat, yellow and grey-white plaques, between which the surface showed pitting and prominent linear and transverse wrinkling, giving a characteristic tree bark appearance. A remarkable feature of the aorta was the presence of four saccular aneurysms, three juxtaposed in the transverse arch, and one lying in the upper descending aorta (Fig. 1). The most proximal was situated on the posterior surface of the aorta opposite the origin of the left subclavian artery. The opening presented a rolled edge and measured 2.0 x 2.0 cm. in diameter. The sac ballooned to a maximal diameter of 4.0 cm. and a depth of 3.0 cm., and was lined by laminated clot. This aneurysm was firmly adherent to the left bronchus and the left anterolateral surface of the trachea, into which it bulged about 0.6 cm. A second and smaller aneurysm lay adjacent to and slightly distal to the first sac, their orifices being separated by only 0.2 cm. of ragged intima. This sac measured 1.5 x 1.5 cm. in diameter, 0.8 cm. in depth, and did not balloon. Its wall consisted merely of clot and thin adventitia. Above, about 0.4 cm. anterior to, and at a level between the first two aneurysms, there was a tiny third aneurysm, measuring 0.4 x 0.4 cm. in diameter and 0.5 cm. in depth; its base was composed of clot. In the lateral aspect of the upper descending aorta, a fourth saccular aneurysm was found, slightly adherent to the anterolateral surface of the esophagus. The opening measured 1.0 x 1.0 cm. in diameter, and the sac ballooned to a maximal diameter of 2.0 cm., and a depth of 0.7 cm. Its base consisted only of laminated clot. No hemorrhage had occurred from any of the aneurysms.

The liver showed moderate congestion. Both kidneys presented adherent capsules and cortical scarring. The second to sixth thoracic vertebrae, inclusive, were eroded along their left anterior surfaces. This erosion bore no close relation to any of the aneurysms and could not be attributed to them.

Microscopic Findings:

Lung: There was patchy bronchopneumonia.

Trachea: There was partial ulceration of the epithelium and diffuse infiltration of the immediately underlying lamina propria by many polymorphonuclear leukocytes. The interstitial tissue of the mucous glands was heavily infiltrated by great numbers of plasma cells and lymphocytes, and a small circumscribed area of subepithelial necrosis was evident. The cartilage bars were partially ossified, and their outer surfaces broken. Multinucleated giant cells, large numbers of plasma cells and lymphocytes surrounded these fragments. Beyond the cartilage, an organizing clot lay upon the necrotic and partially fibrosed wall of the adherent aorta. The small arteries of the tracheal wall showed fairly marked intimal thickening.

Aorta: The media showed marked disorganization and presented areas of necrosis with disruption of the elastic fibers. Near these areas and throughout the media and adventitia the vasa vasorum were surrounded by masses of plasma cells and lymphocytes. Several of these vessels pene-

trated to the intima, which was irregularly thickened by hyaline fibrosis in which were areas of calcification and atheronecrosis.

Kidney: The picture was that of arterial nephrosclerosis.

Final Principal Diagnoses: (1) Asphyxia, acute, due to partial occlusion of trachea by aneurysm. (2) Aortitis, syphilitic, with insufficiency of aortic valve. (3) Aneurysms, syphilitic, multiple (four), thoracic aorta. (4) Tracheitis, acute and chronic. (5) Erosion, thoracic vertebrae. (6) Hypertrophy, heart. (7) Edema and congestion, lungs. (8) Bronchopneumonia, acute, bilateral. (9) Nephrosclerosis, arterial type.

Comment

Since at necropsy the tracheal lumen appeared adequate as an airway, while bronchoscopic examination had revealed the trachea to be almost entirely obstructed by a pulsating mass, the obstruction would seem to have been due to dynamic dilatation of the largest aneurysm during life. One can merely speculate as to the cause of the sudden dilatation. The acute episode began while the patient was drinking through a straw, and it is conceivable that he might have aspirated some liquid, initiating asphyxia, and that the resultant rise in blood pressure produced dilatation of the aneurysm with further asphyxia, and thereby a vicious circle. The elevation in blood pressure and absence of tachycardia shortly after the onset of acute respiratory distress are characteristic of the first phase of asphyxia. The slight relief that was afforded by use of the endotracheal tube and administration of oxygen must have been due principally to aspiration of secretions, since the tube did not pass the site of obstruction.

The presence of four aneurysms in association with aortic regurgitation is unusual. The fact that three of the aneurysms were small was perhaps due to the aortic regurgitation, since enlargement of the aneurysms would not tend to occur in the presence of a lowered diastolic pressure.

SUMMARY

Aneurysms of the thoracic aorta commonly press upon the trachea or bronchi with resultant respiratory difficulty. Acute asphyxiation as the cause of death in patients with such aneurysms is rare. The present report describes a patient who died of acute asphyxia when an aortic aneurysm suddenly obstructed the tracheal lumen. This occlusion was observed bronchoscopically, yet at necropsy the tracheal lumen, though narrowed, was not occluded, suggesting that the tracheal obstruction during life was due to dynamic dilatation of the aneurysmal sac. An incidental finding was the presence of three smaller aneurysms of the thoracic aorta of syphilitic origin.

RESUMEN

Los aneurismas de la aorta torácica generalmente causan presión sobre la tráquea o los bronquios con la resultante dificultad respiratoria. Es muy raro que la asfixia aguda sea la causa de muerte en pacientes con tales aneurismas. En este informa se describe un paciente que murió de asfixia aguda cuando un aneurisma aórtico repentinamente obstruyó la luz traqueal. Se observó esta oclusión broncoscópicamente; sin embargo, en la autopsia, aunque la tráquea estaba angostada no estaba obstruída, lo que sugiere que la obstrucción traqueal durante la vida se debió a dilatación dinámica del saco del aneurisma. Un hallazgo concomitante fue la presencia de tres aneurismas más pequeños de la aorta torácica de origen sifilítico.

REFERENCES

1 Ficarra, B. J.: "Asphyxia Secondary to Aortic Aneurysm," *New York State J. Med.*, 47:1272, 1947.
2 Pernet, A.: "Syndrome of Mechanical Asphyxia Due to Bronchial Compression by Gigantic Aneurysm," *Pub. med., Sao Paulo*, 15:27, 1944.
3 Lucke, B. and Rea, M. H.: "Studies on Aneurysm: II. Aneurysms of the Aorta," *J.A.M.A.*, 81:1167, 1923.
4 Keefer, C. S. and Mallory, G. K.: "The Pulmonary and Pleural Complications of Aortic Aneurysm," *Am. Heart J.*, 10:208, 1934.
5 Kampmeier, R. H.: "Saccular Aneurysm of the Thoracic Aorta. A Clinical Study of 633 Cases," *Ann. Int. Med.*, 12:624, 1938.
6 Boyd, L. J.: "A Study of Four Thousand Reported Cases of Aneurysm of the Thoracic Aorta," *Am. J. Med. Sc.*, 168:654, 1924.
7 Norris, G. W. and Landis, H. R. M.: "Diseases of the Chest and the Principles of Physical Diagnosis," W. B. Saunders, Philadelphia, Pa., 5th Edition Revised. P. 941, 1933.
8 Paullin, J. E. and Minnich, W. R.: "Cardiovascular Syphilis," in "The Diagnosis and Treatment of Cardiovascular Disease," Ed. by Stroud, W. D., F. A. Davis, Philadelphia, Pa., 3rd Edition, Vol. I, P. 180, 1946.
9 Wilburne, M. and Taylor, H. K.: "Multiple Saccular Aneurysms of the Aorta, with Report of Three Cases," *Am. J. Roentgenol.*, 48:797, 1942.
10 Lucke, B. and Rea, M. H.: "Studies on Aneurysm: I. General Statistical Data on Aneurysm," *J.A.M.A.*, 77:935, 1921.
11 Colt, G. H.: "The Clinical Duration of Saccular Aortic Aneurysm in British-Born Subjects," *Quart. J. Med.*, 20:331, 1927.
12 Stokes, J. H., Beerman, H. and Ingraham, N. R. Jr.: "Modern Clinical Syphilology," W. B. Saunders, Philadelphia, Pa., P. 902, 1944.

Chronic Bilateral Basal Pulmonary Fibrosis*

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Chronic bilateral basal pulmonary fibrosis has been selected to designate a condition characterized by chronic cough, moist rales at the lung bases and basal pulmonary infiltration as revealed by x-ray inspection. In some patients presenting these abnormalities, etiological factors can be determined. In others, present methods of diagnosis and prolonged observation fail to reveal the basic causes.

Cough is not infrequently a symptom for which individuals seek medical attention. It is the concern of the patient and the responsibility of the physician that tuberculosis be discovered or excluded. Established silicosis may also be excluded. Paranasal sinus disease and other upper respiratory etiologies may logically be omitted from consideration.

Chronic basal pulmonary infiltration, as revealed by x-ray, may result from a variety of causes. It is important to consider various possible pathological conditions when basal pulmonary fibrosis is discovered.[1-3] In a review of Chronic Nontuberculous Pulmonary Infections in 1939, Hamman[4] presented evidence which would seem to justify the assumption that many of the chronic basal infections of the lungs are a form of bronchiectasis. Ehrlich and McIntosh[5] reported three cases of obliterative bronchiolitis in patients dying with uremia, postulating that a disturbance in metabolism in this state may account for the exudation and proliferation. McCordock and Muckenfuss,[6] in experimental animals, demonstrated that filtrable viruses introduced in proper concentration produced interstitial pneumonitis. This condition favors the subsequent development of fibrosis. In search for the underlying cause one must also consider chronic passive congestion,[7] fibrosis secondary to emphysema or long standing asthma, cystic disease of the pancreas in children[8] and radiation pneumonitis.[9] Similar x-ray shadows are cast by certain stages of lymphogenous dissemination of malignancy,[10] inhalation diseases,[11,12] Boeck's sarcoid,[13] and primary pulmonary arteriosclerosis. More rare conditions such as lipoid reticulo-endotheliosis[14] and leukemic infiltrations occur.

Ninety-nine patients presenting chronic bilateral basal pulmon-

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ary fibrosis have been studied and observed over a period of six months to 10 years. In 18 of these 99 patients, no specific diagnoses have yet been established. Special methods of evaluation have included electrocardiograms, and venous pressure and circulation time studies. Bronchoscopy and bronchograms have been utilized. Vital capacity has been periodically obtained. Sputum examinations, cultures and animal inoculations have been done. Diagnostic therapy has been given for congestive heart failure. Chemotherapy and antibiotics have been employed. Drugs and desensitization to foreign proteins have been used in control of allergy.

The accumulated data revealed that cough, bilateral moist rales and basal fibrosis were associated with specific causes in 81 of 99 patients. Frequently, obscure congestive heart failure was present. Likewise bronchiectasis, pulmonary emphysema or bronchial asthma had been associated frequently with repeated episodes of infection with the production of chronic basal infiltration. Less frequently, lymphogenous dissemination of silent gastric carcinoma presented for a period a pulmonary state of the character under study. Rarely infiltrative primary pulmonary malignancy temporarily presented similar findings. Sarcoidosis in certain instances was confusing. Various pneumonoconioses presented predominantly basal abnormalities. In three instances the pulmonary infection and fibrosis associated with cystic disease of the pancreas occurred chiefly in the lower portions of the lungs. In rare instances pulmonary arteriosclerosis was considered as responsible when this judgment was supported at necropsy. Post-radiation fibrosis presented bilateral basal infiltration and moist rales. In this limited group no case of lipoid pneumonia appeared. Fungus disease was not discovered. None of these cases resulted from the long continued use of a tracheal airway. The diminished cough reflex of idiocy, mental deterioration, alcoholism, uremia and unconsciousness was not etiological in this group. Amyloidosis, xanthomatosis and parasitic infestations were not found.

In 18 patients no etiology was discovered. These patients were well nourished, without anemia, diabetes or exogenous nutritional deficiencies. Eleven were females and seven were males. The average age was 56 with a range of 43-73 years. In 11 dyspnea was handicapping. Fever was present, at what appeared to have been the onset, in three. In three others fever occurred in irregular fashion during extended observation. An abnormal eosinophilia of 16 per cent occurred once during a period of fever. Left bundle branch block was present in one electrocardiogram. This patient did not have cardiac insufficiency. In two instances there occurred improvement in the abnormalities revealed by x-ray film. In

general the condition was slowly and irregularly progressive. In one instance lung biopsy by needle puncture revealed no useful information.

The patients under consideration in this group do not appear to resemble closely the high cholesterol pneumonitis of King and Mallory, the nonspecific pneumonitis of Adams and Kershner, or the chronic pneumonias of Jacobs.[15] The following cases are presented to illustrate some of the problems:

Case 1: A female, 56 years of age, having chronic cough, wheezing respirations, and exertional dyspnea which had been progressive for one year when first seen in 1940. There was no history of dust inhalation. Blood pressure was 170/100, weight 210 pounds. Lung areas were resonant but numerous moist rales were heard in both bases. Liver was not enlarged. There was edema of the ankles. Slight clubbing of the fingers was noted. Electrocardiogram and routine laboratory tests were within normal limits. The original impression was that obesity and hypertension had combined to overload the circulation and that myocardial failure was present. The patient did not respond to usual therapeutic efforts. In the x-ray film of November 28, 1940 the heart and aortic shadows were about normal in size. There was marked hilar enlargement and evidence of extensive infiltration throughout both lungs which was apparently due to fibrosis, most marked at the bases and in the right chest. Bronchograms did not reveal bronchiectasis. Throughout the observation period extending over eight years, symptoms have persisted with exacerbations and remissions, and frequent episodes of upper respiratory tract infections have been difficult to control. Symptomatic relief has resulted from weight loss, ammonium chloride, and bronchial anti-spasmodics. An x-ray film of January 25, 1941 showed no clearing, another in February, 1948 revealed persistence of extensive infiltration. The patient's weight has been 168-170 pounds. Therapy continues to be directed at weight control, symptomatic measures for cough and bronchospasm, and control of recurring respiratory infections with penicillin. It is difficult to designate a specific underlying cause of fibrosis in this case.

Case 2: This patient, a female, aged 60, who suffered from exertional dyspnea and cough (non-productive), is discussed as one representative of pulmonary congestion secondary to heart failure. Her blood pressure was first known to be elevated in 1939 (190/110). Progressive increase in dyspnea occurred. Orthopnea developed on several occasions in 1940. Electrocardiogram in 1939 showed T-1 inversion and diphasic T-2. Digitalis was used intermittently from 1940 to 1946. Since 1946 the patient has been continuously on digitalis and mercurial diuretics have been necessary at frequent intervals in the past year to prevent peripheral edema, liver enlargement, and severe dyspnea. An x-ray film on April 5, 1946 revealed a considerable degree of hypostatic congestion, more marked on the right. Increased linear markings were present in both bases. There was tremendous enlargement of the heart. X-ray films before and since are no different. The patient is reasonably well on a program of limited activity, digitalis, intermittent mercurial diuretics and a low salt diet. The infiltrations noted in this case appear to result from chronic passive congestion.

Case 3: A male, aged 44, is presented as one illustrating inhalation disease. Onset of cough and shortness of breath began five years ago. He was exposed to irritation from dusts of various kinds over an eight year period. He does research work with metal powders. The cough is most marked in the morning with production of white mucus. Vital capacity is 1900 cc. X-ray film shows rather extensive infiltration in both lungs, mostly at the bases with clear apices. The heart and aorta are normal in size and shape. The sputum and gastric washings are negative for tuberculosis. Venous pressure and circulation times are normal. History and findings suggest pneumoconiosis.

Case 4: A female, aged 40, who is presented as one with acute infection accounting for basal infiltration and is not one of the ninety and nine. She had an acute onset of cough, mucopurulent sputum, chilly sensations, and fever of 101-102 degrees which developed one week prior to admission. This patient attended an ill friend who died of virus type pneumonia two weeks prior to her admission. Sulfonamide therapy was begun five days before admission and was discontinued because of nausea and vomiting. Penicillin was then administered but cough and fever persisted and she was admitted to the hospital. The white blood count on admission was 7,340, polymorphonuclear lucocytes 74, hemoglobin 12.2, cold agglutinins 1:64 on admission and rose to 1:4096, 12 days later. No pneumococci were found in sputum smears. An x-ray film showed the heart and aorta to be normal in size, moderate hilar enlargement with multiple calcified hilar nodes on the left side. Accentuated linear markings were seen in the left base and increased density was present in the lower right lung with obliteration of the costophrenic sinus. A film on October 20, showed almost complete clearing of the consolidation in right lower lung field, but there was still increased density with evidence of pleural reaction. The bronchovascular markings were still somewhat heavy. The findings in this case would indicate atypical pneumonia (virus?). Although permanent bronchiectasis is said to be rare following atypical pneumonia, increased markings, delayed resolution, and persistent cough may be sufficient presumptive evidence to warrant bronchoscopy and bronchography.

SUMMARY

It is realized that lesions casting similar shadows by x-ray may be quite different when microscopically examined. Also, comparable tissue changes may result from various causes. With failure of the self-cleansing mechanism of the lung fibroblastic proliferation and replacement can occur whether the substance retained is congestive or infectious in nature, metabolic in origin, or derived from inhaled particles. The cleansing function of ciliary action, bronchial peristalsis and cough is considered to be absent in normal terminal bronchioles. Alveolar cleansing is by lymphatic drainage and phagocytosis. The ultimate lymph channel from the lung is stated by Drinker[16] to be of small caliber with the mechanical effect of a bottle neck. Exudation in excess of absorption can occur with ease.

Pending additional knowledge regarding idiopathic basal pulmonary fibrosis, the therapy attempted has been to arrest further

progress of the disease by the prevention and treatment of recurrent respiratory infections which are frequent, for the symptomatic relief of ineffective cough, and to control alveolar exudation. One consistent feature in the group studied has been age with its increased tissue vulnerability. In a population of increasing age it is probable this condition will be seen more frequently, recognized more easily and ultimately treated more effectively.

RESUMEN

Se reconoce que lesiones que producen sombras semejantes en la radiografía pueden ser muy diferentes cuando se las examina microscópicamente. Además, causas diversas pueden producir alteraciones histológicas comparables. Cuando fracasa la función autopurificadora del pulmón, puede ocurrir proliferación y substitución fibroblástica, ya sea la substancia retenida de naturaleza congestiva o infecciosa, de origen metabólico o derivada de partículas aspiradas. Se considera que la función purificadora de la acción ciliar, de la peristalsis bronquial y de la tos, no existe en los bronquiolos terminales normales. La purificación alveolar tiene lugar mediante los vasos linfáticos y la fagocitosis. Drinker[16] afirma que el último canal linfático que emerge del pulmón es de pequeño calibre y causa el mismo efecto mecánico que un cuello de botella. Por lo tanto, es muy fácil que la exudación exceda a la absorción.

Mientras se obtengan conocimientos adicionales sobre la fibrosis pulmonar basal idiopática, se ha empleado una terapia para detener el progreso de la enfermedad mediante la profilaxia y el tratamiento de las infecciones respiratorias que ocurren con frecuencia, para el alivio sintomático de la tos ineficaz y para combatir la exudación alveolar. Un rasgo invariable del grupo estudiado ha sido la edad avanzada con el aumento concomitante en la vulnerabilidad de los tejidos. Es probable que en una población cuya edad está aumentando se encuentre este estado con más frecuencia, se lo reconozca más fácilmente y al fin se lo trate más eficazmente.

REFERENCES

1 Miller, James Alexander: "Subacute and Chronic Nontuberculous Infections," *Amer. J. Med. Sci.*, 154:805, 1917.
2 Austrian, Charles R.: "Chronic Basic Nontuberculous Disease of the Lungs," *Inter. Clinics*, 3:109, 1931.
3 Cherry, Homer H.: "Chronic Basal Nontuberculosis Pulmonary Inflammation," *Amer. J. Med. Sci.*, 182:367, 1931.
4 Hamman, Louis: "Chronic Nontuberculous Basal Infections of the Lungs," *Amer. Rev. Tuberc.*, 40:363, 1939.
5 Ehrich, Wilhelm and McIntosh, John F.: "The Pathogenesis of Bronchiolitis Obliterans," *Arch. of Path.*, 13:69, 1932.
6 McCordick, Howard Anderson and Muckenfuss, Ralph S.: "The Similarity of Virus Pneumonia in Animals to Epidemic Influenza and Interstitial Bronchopneumonia in Man," *Amer. J. Path.*, 9:211, 1933.

7 Parker, Frederic Jr. and Weiss, Soma: "The Nature and Significance of the Structural Changes in the Lungs in Mitral Stenosis," *Amer. J. Path.*, 12:573, 1936.
8 Attwood, C. J. and Sargent, William H.: "Cystic Fibrosis of Pancreas with Observations on Roentgen Appearance of Associated Pulmonary Lesions," *Radiology*, 39:417, 1942.
9 Widmann, B. P.: "Irradiation Pulmonary Fibrosis," *Amer. J. Roent.*, 47:24, 1942.
10 Mendeloff, Albert I.: "Severe Asthmatic Dyspnea as the Sole Present-in Symptom of Generalized Endolymphatic Carcinomatosis," *An. Int. Med.*, 22:386, 1945.
11 Bolen, H. Leonard: "Byssinosis," *J. Ind. Hygeine and Toxicology*, 25: 215, 1943.
12 Sodeman, W. A. and Pullen, R. L.: "Bagasse Disease of the Lungs," *Arch. Int. Med.*, 73:365, 1944.
13 Bernstein, Solon S. and Sussmann, Marcy L.: "Thoracic Manifestations of Sarcoidosis," *Radiology*, 44:37, 1945.
14 Currens, James H. and Popp, Walter C.: "Xanthomatosis—Hand Schuller-Christian Type: Report of a Case with Pulmonary Fibrosis," *Amer. J. Med. Sci.*, 205:780, 1943.
15 Jacobs, Sidney: "Chronic Pneumonias," *New Orleans M. and S. J.*, 100: 207, 1947.
16 Drinker, Cecil K.: "Pulmonary Edema and Inflammation," *Harvard University Press*, Cambridge, Mass., 1945.

Discussion

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Since the use of x-ray has become universal we are not satisfied by interpreting rales in the base of the lung as simple bronchitis. Chest specialists have been baffled by the many varieties of diffuse pulmonary infiltrations, especially in the lower areas of the lungs. There is, however, no other group of pulmonary diseases which shows up the inadequacy of x-ray diagnosis quite as much. While x-ray is unexcelled in demonstrating the presence of pathology, it is by no means unexcelled in differential diagnosis.

We should be careful in the use of the word fibrosis. Within the range of the x-ray appearance of these conditions are also malignancies, especially the diffuse perilymphatic and peribronchial infiltrating carcinomas. Some of us may be a little more experienced than others in differentiating basal infiltrations by x-ray, but essentially the roentgen diagnosis always remains guesswork and diagnosis must be made by other means. As the authors pointed out, some of these conditions—in their report 18 per cent—defy all attempts at diagnosis, occasionally even on macroscopic inspection at autopsy.

How insecure our clinical criteria are was demonstrated to us by the case of a woman, who had this type of diffuse infiltration. She was suspected of having sarcoidosis, because of the experience with the elevation of gamma-globulin values in the blood serum

in that disease. Her gamma-globulin value was the highest we had ever obtained in any patient. She died, and the pathologists were certain that she had not had sarcoidosis. The final pathologic diagnosis was scleroderma of the lung.

Dr. Volini, in the closing remarks of his paper, mentioned the work of Arnold Rich, who has called attention to the anaphylactic reactions following chemotherapy. He has pointed to periarteritis nodosum in patients as the result of treatment by a variety of agents, especially by the sulfonamides, and has proved his point by animal experiments. He has also pointed out that many of these pulmonary infiltrations can be the result of such anaphylactic reactions.

I wish to congratulate the author on this presentation. We should have more papers dealing with these baffling conditions, which are slowly progressive but almost invariably lead to death by secondary cardiac involvement. The possibility of tuberculosis in these diffuse infiltrations should not be lightly discarded. The diffuse, chronic, slowly progressive type of tuberculous disease, often termed senile tuberculosis, should be considered a diagnostic possibility even if the tuberculin test is negative; tubercle bacilli in the sputum may be found either not at all or in very small numbers and only occasionally.

A. CARLTON ERNESTENE, M.D.
Cleveland, Ohio

The etiologic factor in chronic bilateral basal pulmonary infiltration usually can be discovered without too great difficulty. There is, however, a sizeable group in which accurate diagnosis cannot be made even after the most detailed investigation. Careful and complete studies are indicated in every case that presents the type of x-ray picture Dr. Goodrich has reported. This is necessary not only to guide one in recommending the appropriate type of medical treatment, but also to detect those cases which, with the steady progress of thoracic surgery, may be amenable to surgical management. In this latter respect, instances of unilateral basal pulmonary fibrosis often present a more important diagnostic problem, for it is in this group that the number of cases in which thoracic surgery will be indicated is greater. In individuals who have unilateral pulmonary basal fibrosis, particular emphasis should continue to be placed upon the need for early bronchoscopic examination. Time spent in merely observing the clinical or roentgenographic progress in patients who have unilateral processes may mean the loss of that margin which is so necessary for successful surgical intervention.

EDWIN R. LEVINE, M.D., F.C.C.P.
Chicago, Illinois

Dr. Goodrich is to be congratulated for bringing to our attention the chronic bilateral basal lesion, about which too little thought is given. It would seem that this sort of lesion is the penalty we pay for being animals that walk in the upright position. It is due to lack of drainage in the basal areas of the lung. In a clinic in which a large number of patients with pulmonary complaints are seen, we are more and more aware that these so-called minor bronchial conditions which do not annoy the patient particularly but continue for a long time, eventually become serious. Some years ago the medical profession did not have to worry about that; the patient died of cancer or tuberculosis or some other infection long before these conditions caused any complaint.

These minor chronic conditions are becoming major problems. It would seem that not all of them by any means can be classified as fibrosis. The majority are dependent upon residual infection in the bronchi and lack of drainage, or an area of atelectasis. Those conditions will produce fibrosis, but I believe emphasis must be laid on the fact that atelectasis without infection will not produce fibrosis. We have all known lungs to expand after a period of years, without evidence of fibrosis. We come back to the question of infection, and our observations on patients with chronic conditions in the chest have indicated that there is infection in every case, and we can isolate the organisms present in the infection, regardless of whether or not the patient is suffering from the infectious condition. These minor conditions must be treated as potentially serious ones. Once they become well established therapy is increasingly difficult. While they are minor and causing no symptoms they should be checked before irreversible changes occur.

Dr. Goodrich mentioned temporary bronchiectasis. I do not believe in that. Temporary dilation of the bronchi, perhaps—but bronchiectasis represents permanent expansion, and I do not believe the bronchi can be returned to a normal state. Dr. Ernestene mentioned unilateral fibrosis and the possibility of surgery. But careful study of a lung that shows no shadow often reveals it to be as diseased as the one that does. We may see it change from one side to the other; year after year it may be evident on one side, then change to the other. It is due to lack of drainage, to obstruction. The use of aerosol therapy, and most of all, adequate positional drainage or bronchoscopic drainage if necessary, may prevent these conditions. I think as time goes on we will have more and more patients of the type we have discussed today.

Closing Remarks

Ben E. Goodrich, M.D., F.C.C.P.: I could hope for nothing better than to attend some meeting in the future when one of these discussants and any others will more ably consider this subject and present reports thereon.

Dr. Bloch comments on the use of the term fibrosis when it is likely the infiltration at times is not fibrosis. The use of this term is inherited from x-ray in that a chronic persisting basal pulmonary infiltration is not infrequently designated as fibrosis by the radiologist. Fibrosis has been reported to result from various diseases of diverse origins. Allergic responses may produce tissue fibrosis whether chemotherapeutic in origin or on an experimental basis as shown by Rich. Possibly some portion of the tissue change in primary atypical pneumonia may be of this origin.

Dr. Bloch stresses the diffuse basal lesions of pulmonary tuberculosis particularly in the elderly patients. Those patients who proved to have tuberculosis, were excluded from this report. It is possible that among the undiagnosed group, tuberculosis as yet undiscovered, may be present and he has inferred that surety cannot be established short of microscopic examination.

Dr. Ernstene states that one cannot overstress the importance of malignancy, especially in patients where the lesions are more localized. This is, as he says, important because there is the possibility of surgical removal.

Dr. Levine mentioned the importance of infection. Whatever the original cause, once established, repeated infections become a great part of the problem and the necessity is great for prompt treatment of episodes of even minor infections in the elderly.

The word temporary bronchiectasis was inferred because of dislike for the word pseudo-bronchiectasis as used by Blades to designate the temporary dilatation of bronchi following atypical pneumonia. Dr. Blades' point is well taken that bronchiectasis following primary atypical pneumonia should not be surgically treated since the bronchial dilatation may be of temporary nature.

Basal Tuberculosis Simulating Sub-Phrenic Abscess*

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Because of its insidious nature a subdiaphragmatic abscess may not manifest itself until it has progressed to the stage of causing pulmonary pathology. Pleuro-pulmonary involvement such as effusion, pneumonitis, atelectasis, etc., at the base of the lung on the involved side may be the first changes to call to mind the possibility of sub-phrenic pathology. The following case is of interest because the history, physical findings, and roentgenograms were consistent with the diagnosis of subdiaphragmatic abscess, but subsequently the pathology was proved to be due to tuberculosis localized in the basal segments of the right lower lobe.

J.P., R No. 3279, is a 60-year old white male who has been hospitalized for the past 20 years because of paranoid schizophrenia. Previous to his present illness, he had always been in good health, and numerous physical examinations and chest roentgenograms had been entirely negative. On December 5, 1946 a chest roentgenogram was reported as negative and a review of this film showed no evidence of infiltration or scarring due to an old arrested lesion. On February 4, 1947 he complained of abdominal pain, was distended and appeared pale. Roentgen studies revealed evidence of intestinal obstruction. Laporatomy was performed the following day when a volvulus of the sigmoid was relieved and a colostomy performed.

The postoperative course was unsatisfactory due to a low grade fever with frequent high spikes accompanied by leucocytosis. There was no cough and the patient would not comment on his complaints. A roentgenogram of the chest on February 14, 1947 revealed increased markings of both lung fields probably due to elevation of the diaphragm (Fig. 1). There was a small amount of air under the right leaf of the diaphragm remaining from the previous operation. This demonstrated a smooth diaphragmatic contour. No evidence of infiltration in the lung was observed.

The patient remained chronically ill and penicillin therapy was administered for approximately two months. A film of the chest on April

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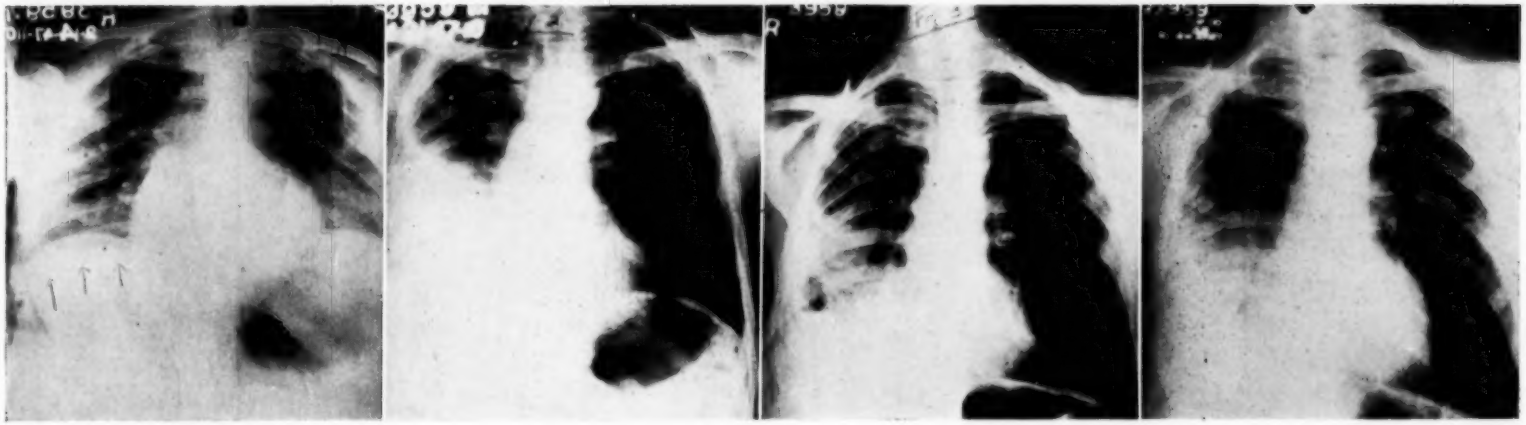

FIGURE 1 FIGURE 2 FIGURE 3 FIGURE 4

Figure 1: Roentgenogram of the chest showing air under the right leaf of the diaphragm and demonstrating smooth diaphragmatic contour (2-14-47).—*Figure 2:* Pleuro-diaphragmatic effusion obscuring underlying parenchymal detail (4-21-47).—*Figure 3:* Multi-locular fluid levels at the right base with irregular parenchymal infiltration.— *Figure 4:* Dense pleural thickening at the right base, obscuring parenchymal detail.

21, 1947 revealed a dense pleuro-diaphragmatic effusion extending up to the middle of the chest wall on the right side, obscuring underlying parenchymal detail (Fig. 2). The remainder of the lung fields showed no evidence of abnormality. The possibility of subdiaphragmatic pathology was suggested.

The colostomy was closed on May 13, 1947. On May 29, an abdominal fistula was noted to be draining fecal material. Lipiodol was instilled into the fistulous tract and a communication with the sigmoid colon was demonstrated roentgenographically. In July, 1947 it was noted that the patient had a cough and raised yellow, foul-smelling sputum. Studies at that time revealed no evidence of tubercle bacilli on smear or culture. The patient failed to gain weight and appeared chronically ill, although he was now ambulatory.

Serial roentgenograms of the chest over the next three months revealed evidence of multi-locular fluid levels at the right base with irregular parenchymal infiltrations in the underlying lung field. The remainder of the lung fields still remained clear (Fig. 3). The persistence of the pleuro-pulmonary changes at the right base had prompted the X-ray Department on numerous occasions to suggest the presence of sub-phrenic abscess. On October 1, an exploratory operation was performed. The subdiaphragmatic space on the right was approached posteriorly by removal of the 12th rib. The peritoneum was incised and the right anterior and posterior subhepatic spaces were palpated. Finger dissection was carried superiorly over the lateral right ligament of the liver to the bottom of the diaphragm but no area of suppuration was found.

The postoperative course was uneventful, but the patient remained unimproved. By December 12, 1947 the abdominal fistula had closed. On January 28, 1948 a pleural tap was done, and a smear of the fluid showed tubercle bacilli. This diagnosis was verified by gastric cultures. Pneumoperitoneum was attempted, but was not successful because of massive adhesions. The patient has done moderately well on bed rest and at the present time he has dense pleural thickening at the right base, obscuring parenchymal detail (Fig. 4).

Discussion

Thoracic complications are common in cases of sub-phrenic abscess; Claggett,[1] for example, found them in 65 per cent of his cases. While the clinical findings in this case suggested subdiaphragmatic abscess, the roentgenographic finding of a basal pleuro-diaphragmatic fluid accumulation was compatible with various other infra and supra-diaphragmatic lesions. These include diaphragmatic hernia; ovarian tumor (Meigs Syndrome); hepatic abscess, inflammation or tumor; inflammatory changes of the lung and pleura; pulmonary neoplasms; heart disease; and eventration of the diaphragm. Basal pleural fluid[2] for example, has been described as causing apparent elevation of the diaphragm.

As pointed out by Reisner[3] it is important to distinguish between tuberculous infiltrations of subapical portions of the lower lobes and those involving the basal segments since the latter is

much more uncommon. Tuberculosis should not be forgotten when a puzzling lower lobe lesion is being investigated and repeated laboratory studies should be performed to rule it out.

Reisner[3] has postulated that a high diaphragm or one with restricted movement may cause poor aeration of the lower lobe and that this is a predisposing factor to lower lobe tuberculosis. This may apply in the above case since splinted respiration with limitation of the diaphragmatic excursion is expected following abdominal operations.

SUMMARY

A case of basal tuberculosis simulating subdiaphragmatic abscess is reported and discussed.

RESUMEN

Se presenta y discute un caso de tuberculosis basal que parecía ser un absceso subdiafragmático.

REFERENCES

1 Claggett, O. T. and Finney, W. S.: "Subphrenic Abscess with Reference to Intraxthoracic Complications," *Am. J. Surg.*, 66:189, 1944.
2 Jones, Dean B.: "Basal Pleural Fluid Accumulations Resembling Elevated Diaphragm," *Radiology*, 50:227, 1948.
3 Reisner, D.: "Pulmonary Tuberculosis of the Lower Lobe," *Arch. Int. Med.*, 56:258, 1935.

Surgical Therapy of Pulmonary Tuberculosis at a Veterans Administration Chest Center*

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Indications and variations in the surgical approach to pulmonary tuberculosis are still in a state of constant change and while a few procedures have become permanent fixtures in the thoracic surgeons armamentarium, there are numerous satellite operations popular with some and rejected by others; all this bearing testimony to the fact that in the absence of a definitive chemotherapy or antibiotic agent able to eradicate the disease there remains many a therapeutic problem allowing more than one answer. Frequently, therefore, in the field of surgery of tuberculosis the question of what to do and when to do it is settled by a cooperative effort through a conference in which medical men, roentgenologist, pathologist and surgeons participate. The make up of a large medical organization functioning on a nationwide scale as the Veterans Administration does, requires and promotes the cooperative effort of medical men of different training and background, representing various schools of thought.

The exchange of ideas on various aspects of the management of the surgical problems dealt with, quickly culminated in the development of a common approach and a therapeutic policy combining elements stemming from different trends of thought and representing a digest of experience gained not only at this institution but at various other hospitals as well, with which the individual surgeons of the group happen to be affiliated.

Additional points of interest have come up in connection with the use of streptomycin in the surgery of tuberculosis. The main problems having arisen in this respect are: (1) Evaluation of the efficacy of the antibiotic agent to prevent and to combat spreads. (2) The high incidence of streptomycin resistance and the necessity therefore of proper timing of antibiotic treatment and surgery.

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(3) Advances made in the surgery of pulmonary tuberculosis since the introduction of streptomycin and changes in the indications of the various technical procedures in connection with the use of the drug.

While the patient material of this hospital (Castle Point) is obviously not large enough to permit final conclusions and answers to these problems, enough experience has, however, been gained to indicate some definite trends.

The hospital cares for an average census of about 600 patients with a fairly rapid turnover. Activities of the surgical service include bronchoscopic, bronchographic, and respiratory functional work-up in addition to the various operative procedures. The period from March 1947 to March 1948 has been arbitrarly selected for review. The overall activities of the service for this period of time are given in Table 1 (compiled November, 1948).

TABLE 1

1) MAJOR PROCEDURES:		
a) Thoracoplastic operations		108
(1) 1st stages	40	
(2) 2nd stages	37	
(3) 3rd stages	28	
(4) 4th stages	3	
b) Revisions		9
c) Open pneumonolysis		5
d) Resection for pulmonary tuberculosis		12
e) Thoracotomies		5
f) Pleurectomies		2
g) Cavernostomies		2
h) Closure of cavernostomy by muscle flap		2
		145
2) MINOR PROCEDURES:		
a) Scapulectomies		4
b) Phreniclasia		55
c) Closed pneumonolysis		53
d) Bronchoscopy		123
e) Bronchography		21
f) Bronchospirometry		11
		267

A total of 145 major procedures has been carried out for the treatment of pulmonary tuberculosis. There has been no mortality. Table 2 gives a survey of complications encountered in this group.

TABLE 2

1) Tuberculous spreads	5
2) Wound infection, tuberculous	1
3) Wound infection, pyogenic (abscess)	1
4) Cardiac decompensation	1
5) Wound disruption	1

Each of the complications will be discussed further in connection with the type of procedure following which it occured.

Closed and Open Intrapleural Pneumonolysis

The severance by surgical means of adhesions occuring during pneumothorax treatment is an ancillary procedure, the end results of which are dependent upon the efficacy of the pneumothorax proper. No effort will therefore be made to evaluate results in terms of sputum conversion. Emphasis should be placed upon complications encountered in the performance of pneumonolysis and upon results in terms of technical perfection of the pneumothorax in a given case. As far as the indications are concerned it has become our guiding rule that a pneumothorax which is unsatisfactory due to the presence of adhesions had best be abandoned and be replaced by some other form of therapy inasmuch as complications are prone to follow sooner or later. If one feels that it is desirable to maintain a pneumothorax the feasibility of severing existing adhesions can only be ascertained by exploratory thoracoscopy. (The optimum time for thoracoscopic exploration is between six and eight weeks after induction of pneumothorax.)

It has become our practice to attack only the simple band and string adhesions by direct division of the adhesion proper near its parietal attachment. All other types of more extensive adhesions have been removed by enucleation in the extrapleural plane. The crux of the situation lies, of course, in the decision as to how extensive a procedure may be permissable. The yard stick in this respect has been the distribution of disease. In unilateral cases wide dissections have not been attempted. Unilateral cases in whom it appeared to the operator that lysis could not be completed in one session and without denuding large pleural surfaces have been rejected and recommended for some other type of surgery. The frequent occurrence of postoperative sero-hemorrhagic effusions even though these might be benign and not necessarily lead to tuberculous exudates, carries with it a high precentage of poor results as far as pulmonary function after future re-expansion is concerned. In addition there is the even greater risk of specific and mixed infection in the pleural space, a risk which is not acceptable in cases with unilateral disease.

In the presence of bilateral disease with cavitation in both lungs where control of one side by pneumothorax would appear to be mandatory the indications for lysis have been somewhat wider. However even in this type of case we have been reluctant to perform important decollations especially where the adhesions involved the mediastinal surface. In the literature there exists a

wide divergence of opinion in regard to this type of lysis. While one group of operators testify to the innocuousness of the procedure and back this opinion up with statistical data others are set against wide decollations and point to the high incidence of pleural complications. Obviously, in this type of tedious and often technically difficult procedure the individual skill becomes an important factor. A few facts deserve to be stressed no matter how skillful the operator, when wide decollations are undertaken. First, the field of vision is often partially limited and as soon as some bleeding has occurred tissues can no longer be identified with absolute certainty. Second, the degree of penetration of the heat liberated by the cautery cannot be gauged with accuracy. These two factors create a situation beyond the control of the operator. Reasoning along these lines one is led to the possibilities of open lysis by thoracotomy and the indications thereof. Surgical invasion of the pleural cavity for the purpose of lysis of adhesions is an old procedure. The experience in earlier years or rather in earlier decades has by and large been unfortunate and marked by a high incidence of pleural infections. It was only natural that with the advent of newer techniques and of the antibiotics attention was again given to the procedure. There is no doubt that invasion of the pleural cavity has become much safer now. One cannot help feeling that the trauma inflicted upon the pleural surface by open thoracotomy is hardly greater than when the procedure is done by the closed method. We believe it is smaller and what is even more important, the dissection can be carried out with greater safety under direct vision in the extrapleural layer if necessary and whatever bleeding may occur can be adequately controlled. Inspection of the pleural cavity during the preliminary thoracoscopy will give important information on the state of the pleural surfaces and will eliminate those cases in which the presence of visible tuberculous involvement presages complications. The pleural sequelae should be identical in both types of procedures. Some deposit of fibrin on the pleural surfaces must evidently be expected and will undoubtedly lead to some functional impairment after future re-expansion. The risk in this respect would seem no different in the open than in the closed procedure. We have felt justified in recommending open pneumonolysis in a small number of cases with bilateral disease rather than to accept the risk of wide decollations by closed pneumonolysis. Table 4 shows the proportion of each indication in the total number of cases.

The posterolateral or the anterior approach have been used with or without removal of a rib. The chest was closed tightly. Streptomycin was given systemically for one week preoperatively and

TABLE 4

1) Closed intrapleural pneumonolyses		53
a) Remained exploratory thoracoscopies	14	
b) Lysis performed	39	
c) Complications in this group:		
(1) Tuberculous empyema		0
(2) Mixed infection empyema		1
(3) Benign temporary effusion		8
(4) Subcutaneous emphysema, marked		15
(5) Adhesive pleuritis		0
2) Surgical intervention for the establishment of a pneumothorax space		5
a) Complications in this group:		
(1) Tuberculous empyema		0
(2) Benign temporary effusion		5
(3) Mixed empyema		0
(4) Adhesive pleuritis		0

for two weeks after the procedure and one gram of the drug was left in the pleural cavity at the time of operation but none was instilled intrapleurally during the postoperative course. Constant attention must be given postoperatively if the space is to be maintained successfully. As many as four aspirations and refills have been necessary during the first 24 hours after operation. Serosanguinous exudate in the pleural cavity should be removed completely and with great care so as to avoid deposits on the pleural surfaces and obliteration of the space by adhesive pleuritis. Though the number of cases is small we have been satisfied with the result in four of five cases. Two of the cases present new and interesting features and will be discussed in greater detail, as they demonstrate an extension of the procedure into a new field from the technical point of view. Both cases presented bilateral lesions. In the first case a pneumothorax space had been present on one side but had subsequently been lost while the patient had left hospital care temporarily against medical advice. The second case never had a pneumothorax and attempts to create one had failed on both sides. In both cases a pneumothorax space was established surgically with success by the open method and their postoperative course was entirely uneventful and in no way different from the remainder of the group. While the procedure was technically successful in the first case the clinical result was disappointing for the cavity present did not close and its behavior suggested the presence of a tension mechanism. While this, of course, was suspected preoperatively, no definite prediction could have been made as to the behavior of the cavity under pneumothorax and as control of one side was imperative and no other method available it was decided to perform the procedure. Since then the pneumothorax has been re-expanded and no ill results have followed. We feel

that this occurrence is important as it has bearing on the choice of cases for the procedure.

To summarize the indications briefly: Open pneumonolysis has been recommended in bilateral cases in whom control of one side appeared to be mandatory. The open method has been chosen in preference to wide decollation by the closed procedure. In two cases a pneumothorax space has been artificially created by surgical means. This has been technically successful in both cases undertaken. While the procedure was entirely satisfactory from the clinical point of view in one case, in the second instance the lesion was resistant to the pneumothorax, due to the type of lesion encountered. Of a group of 53 cases with adhesions complicating an otherwise desirable pneumothorax 39 were sectioned by the closed method, three were sectioned by the open method and 11 remained exploratory and re-expansion was recommended.

Thoracoplasty

During the one year period covered by this report a total of 108 thoracoplastic operations were performed. These include 40 first stages, 37 second stages, 28 third stages and 4 fourth stages. While the majority of these procedures were performed for the treatment of parenchymal lesions some were carried out for obliteration of an empyema space, resulting from either mixed or pure tuberculous pleural infections. In this latter group, are a few cases with controlled underlying lungs. The indications in this group conform to the classical concepts. In the technique there has been one variation that deserves further discussion. The cases fall roughly into two categories. In approximately half of the cases the transverse process of the first rib was left in. In the second group the transverse process of the first rib was removed. There is no additional technical difficulty in this procedure and the resulting anatomical collapse compares favorably with that obtained in the first group. The x-ray shows that regeneration of the bony plate sets in closer to the spine and the gutter usually seen between spine and bony plate fails to develop. The upper portion of the lung seems anatomically better collapsed. It is fully realized that perfect anatomical collapse does not necessarily entail a good clinical result which to a great degree depends upon the type of pathology being collapsed by the procedure. There has been no significant difference obtained in the clinical results and the number of conversions has been about the same in both groups. However, it should be borne in mind that the total number of cases is so small that differences in the pathological type of lesion treated will decidedly have a greater influence on the results than a slight variation in technique. While a good technical and

anatomical result by no means insure healing of the lesion it is to be emphasized that the aim should still be anatomical collapse as nearly perfect as possible. The results obtained in this group are in line with those reported from other institutions. The following figures are for those cases in whom at least four months of follow-up are available and in whom the thoracoplasty has been performed for the control of a parenchymal lesion.

Total number of cases	23
Apparently arrested with sputum negative on concentration for more than 6 months and cultures, cultures negative on activity	11
Quiescent, with sputum negative for more than 6 months	5
Improved with predominantly negative sputum but occasional positive sputum	2
Thoracoplasty failures with positive sputum	5

Far more interesting is the occurrence of complications. Streptomycin has been employed pre and postoperatively in alternate cases. This has been done according to the protocol of a nation-wide study conducted by the Veterans Administration. (This protocol has recently been discontinued and future surgical cases will be treated with streptomycin only when this appears to be specifically indicated.) Alternate cases of a consecutive series have been given streptomycin for one week preoperatively and for two weeks postoperatively. In the treated group eight cases in whom 21 operations were carried out have received a daily dose of two grams and three cases with nine operations have received a daily dose of one gram. No serious renal or allergic complications of the drug have been encountered. Almost all of the two gram cases developed vertigo whereas none of the one gram group showed this condition. The complications following thoracoplasty with and without streptomycin were as follows:

1) Wound disruption occurred in one non-streptomycin treated case. Wound healed secondarily.
2) One late wound abscess (pyogenic) occurred in a non-streptomycin treated patient and healed uneventfully after revision and drainage.
3) One case developed cardiac failure after the second stage and the thoracoplasty was not carried any further.
4) Spreads:

In the streptomycin group	1
In the control group	3

Only the tuberculous spreads are of significance in relation to the streptomycin treatment. In this particular group there was a definitely higher incidence of postoperative spreads in the non treated group. It is only fair to state that we understand that in the overall picture gathered from the entire Veterans Adminis-

tration setup this discrepancy has failed to develop. It might well be that in such a small series as ours differences in pathology tend to have greater weight in the picture than they would have in a larger series. All spreads in the non-streptomycin group, once recognized as such have after a suitable period of observation, received streptomycin and have cleared up satisfactorily. None has interfered with the completion of the thoracoplasty and none has needed additional treatment with the antibiotic. Table 5 gives a picture of the total number of operative cases (thoracoplastic and other procedures) having received streptomycin. It shows that only two spreads occurred in the entire group of 35 patients having undergone 63 operations.

Procedure	*Cases*	*Streptomycin q24h*	*Operations*	
Thoracoplasty	8	2 gm.	21	
Thoracoplasty	3	1 gm.	9	
Lobectomy	4	2 gm.	4	
Lobectomy	3	1 gm.	3	
Pneumonectomy	4	1 gm.	4	
Revisions	3	2 gm.	3	
Revisions	3	1 gm.	3	
Thoracoplasty for empyema	2	1 gm.	)	10
	1	2 gm.	)	
Open pneumonolysis	2	2 gm.	2	
	1	1 gm.	1	
Schede	1	1 gm.	1	
TOTAL	35		63	

There is no doubt that streptomycin has a considerable therapeutic effect on the early exudative type of lesion which, of course, is the prototype of pathology present in a tuberculous spread following an operative procedure. It does not influence to any great extent the older type of lesion and cannot by itself bring about closure of areas destroyed by the disease. For these reasons it is obvious that in the treatment of pulmonary lesions the greatest value of the drug is in conjunction with surgical procedures designed either for collapse or removal of diseased areas. The frequent occurrence of resistance to the agent raises an important problem. Approximately 60 per cent of the treated cases seem to develop resistance to the drug. The dose administered has less influence upon this mechanism than the time element. Sixty days seems to be the length of time after which resistance must be expected, regardless of whether a small or a large dosage has been employed.

If this is so, and as there is no possibility of predicting in a

given individual case whether resistance will become manifest, one is under obligation to plan carefully for the use of the drug in conjunction with other therapeutic measures. Frequently, in recent months, as the number of streptomycin treated cases have increased, patients have been brought up for consideration of various surgical procedures to consolidate gains that have been made with the antibiotic. Often surgery has been pushed in order to coincide with the period of effectiveness of the drug. While it is true that probably in many a case this has resulted in the patient's coming to surgery better prepared and at an earlier period than possibly could have been expected before the advent of streptomycin, attention should nevertheless be drawn to the fact that in some cases it would have been better to keep the antibiotic in reserve for a later stage of therapy. It must be recognized that the drug produces resistance in a high proportion of cases and that one must have a long range plan for its use when the need for it is greatest.

One of the problems in the treatment of pulmonary lesions by thoracoplasty is the management of the larger apical cavities, the so-called giant cavity. The results in this particular group of cases have been notoriously poor and a number of procedures have been designed to cope with this difficulty. One of the approaches to this problem has been to combine the collapse procedure with drainage. The most popular method has been an anterior thoracoplasty followed by Monaldi suction through this site, and later completion of the thoracoplasty by a posterior approach. This permits, in cases where the cavity is favorably located, drainage through the anterior site and a posterior procedure which avoids the contaminated field.

In our thoracoplasty series there have been a number of giant cavities, some of them with marked sputum production. A somewhat different approach has been used with satisfaction. Thoracoplasty performed in reverse order, i.e. from below upwards will, we believe close a higher proportion of these giant cavities than when the orthodox thoracoplasty is performed. Originally, the method of doing the lower stages first was used to obviate the danger of ipso-lateral spreads into the lower lobe.

The underlying thought was to avoid this occurrence by collapsing the lower portion of the lung first. However, in addition this procedure probably produces a more gradual collapse of the involved area due to the fact that the infiltrated and indurated chest wall following the lower stages only gradually conforms to the maximum collapse (over a period of perhaps five to ten days) following the last upper stage. After a certain number of cases had been done in this particular way it became apparent that

astonishingly good collapse could be obtained by this method and that a high percentage of the so-called giant cavities will yield to this approach.

Excisional Surgery

Differences of opinion still exist with regard to the indications and the results of excisional surgery in the treatment of pulmonary tuberculosis. Since the improvements in operative technique and anesthesia have made the removal of tuberculous pulmonary tissue a practical procedure, the pendulum of opinion has made a wide swing. During the earlier phase of the experience with the procedure, the emphasis has been on a reduction in the immediate postoperative mortality, avoidance of complications, and generally speaking on a widening of the indications in order to test the limits of the procedure. Today the picture has changed. There is little postoperative mortality in most hands and the emphasis now is given to an investigation of the long range results and upon the proper selection of cases from that point of view. As the follow-up periods have increased the indications have been reduced to narrower limits.

During the one year period selected for this study twelve resections have been performed. The relative frequency with which recommendation for resection has been recommended in comparison to other procedures is as follows: during the same period of time 108 thoracoplastic procedures have been done (in approximately 40 cases) and another 25 cases have been recommended for various other procedures like revisions, etc.

No mortality has occurred in this group of resections. All cases have been treated with streptomycin for one week preoperatively. Postoperatively these cases have received streptomycin for 60 days. The only complication that has occurred in this group has been one contralateral spread in a pneumonectomy case. There has been some resolution of this bronchogenic seeding with the streptomycin but the clearing has not yet been complete.

It has been routine policy to follow the resection with limited thoracoplastic procedures to avoid over-distension of the remaining parenchyema.

There is nothing in the technique we have employed that deserves special mention. Particular attention has been paid to obtaining a bronchial stump as short as possible and to closure of the stump by simple, longitudinally placed, terminal sutures. There is no need to emphasize the all important part played by the anesthesia team in maintaining adequate oxygenation and keeping a clear tracheo-bronchial tree at all times. These are

fundamental for good results in this type of surgery. The indications in these 12 cases are given in the table below:

Total number of excisions	12
Lobectomies	6
Segmental resections	1
Pneumonectomies	5
Indications:	
A) Lobectomy:	
1) Tuberculoma (isolated, solid or semi-solid Caseoces focus)	2
2) Upper lobe lesion with broncho-stenosis	2
3) Thoracoplasty failure	1
4) Lower lobe cavity (resistant to pnx)	1
B) Segmental:	
1) Tuberculoma	1
C) Pneumonectomy:	
1) Thoracoplasty failure	2
2) Combined pleurectomy and pneumonectomy	2
3) Upper lobe lesion associated with lower lobe cavity resistant to pnx	1

General agreement has been reached as to the legitamate indication of resection for isolated tuberculoma, thoracoplasty failure and uncollapsable lower lobe cavity. Also, when severe bronchostenosis is present and a thoracoplasty is therefore contra-indicated, resection becomes the procedure of choice. The difference of opinion at present centers upon the group of so-called predicted thoracoplasty failures, i.e. the group of cases of destroyed lungs where there is a great amount of disease but absence of marked bronchostenosis. Some feel that the thoracoplasty in this type of case can be predicted to result in failure to close the lesion and that therefore it is better to carry out primary excision. Arguments advanced in favor of this approach are that resection after thoracoplasty is technically more difficult and carries a higher operative mortality and that once the chest is open one is frequently confronted with a great deal of disease in the lower lobe and total pneumonectomy must be performed rather than removal of a lobe. It is reasoned that the lower lobe disease represents an ipso-lateral spread from a lesion incompletely collapsed by the preceeding thoracoplasty.

While it is impossible with the present length of follow-up available to decide upon the validity of the conception set forth above, attention should nevertheless be brought to several important facts: It must be emphasized that it has been a common experience by all those performing thoracoplasties in great numbers that accurate prediction as to cavity closure cannot be made with sufficient accuracy. Often collapse done for a relatively small lesion that would appear thin walled, fails and a procedure

carried out for giant cavities or destroyed lungs yields a complete closure and conversion against all expectations. It must also be recognized that even though a thoracoplasty might not close a cavity completely, it still might lead to considerable improvement in a patient's condition. The lesion has been collapsed to some extent, the sputum has diminished, toxicity has subsided and although the conversion is not complete one is dealing with a patient who is in altogether better shape and shows more resistance to the disease. Perusal of the follow-up studies that have appeared in the literature so far would lend support to this view and indicate that while the immediate mortality in the group of resections performed for thoracoplasty failures might be somewhat higher this is still out-weighed by the far better, long range performance of this group.

It seems questionable also whether the extensive lesions found in the lower lobes of those patients who come to resection after thoracoplasty, really represent ipso-lateral post thoracoplasty spreads. It might well be that these lesions were present before the thoracoplasty for it has become common experience, since the advent of resection in larger numbers of cases, that the operator is frequently confronted with an impressing number of foci that he can palpate at the operating table but which he was totally unable to see on the x-ray.

For all these reasons we have felt inclined to recommend that a thoracoplasty be done first in this type of case, to be followed later by resection if conversion is not obtained.

In the above shown table of indications the group of combined pleurectomy and pneumonectomy deserves further discussion. Only a few of these procedures have been done for the treatment of cases complicated by the presence of empyema. The first case of this type carried out at this institution had a previous two stage thoracoplasty done several years ago for the presence of a large apical cavity. This had failed to collapse the cavity to any extent and after the second stage a mixed infection empyema had resulted and had to be drained by a closed thoracotomy. The contra-lateral lung had remained free of disease. While further continuation of the thoracoplasty followed by a Schede operation possibly could have resulted in a good result as far as the empyema was concerned it obviously would have failed to control the parenchymal lesion which had remained widely patent under the upper stages of the thoracoplasty. The problem was a double one, parenchymal and pleural. We felt that the indication to perform a complete excision was perfectly legitimate because one was dealing with a thoracoplasty failure as far as the parenchymal disease was concerned. If the procedure was to be successful it

meant control of the pulmonary lesion and avoidance of numerous thoracoplasty procedures followed by mutilating pleurectomy for the treatment of the mixed infection empyema. Had we been unsuccessful, infection of the pleural space would have resulted, but this was already present. Several of these procedures have since then been performed with uneventful recovery and primary closure of the wound. These cases demonstrate that with the help of streptomycin, an infected pleural space need not stand in the way of pulmonary resection if the latter is indicated. It seems important to discuss the indications of this new technical extension of resection. The crux of the situation lies in a correct evaluation of the parenchymal pathology present, i.e. whether one is dealing with controlled or uncontrolled disease in the underlying lung. Some have felt that it is legitimate to apply combined pleurectomy and pneumonectomy to cases who have mixed infection empyema with controlled underlying disease in order to avoid the mutilating Schede. Again, others have extended the indication to simple tuberculous empyemata with uncontrolled or even controlled parenchymal disease. Although no large experience with these combined resections have been accumulated as yet, one would be inclined to surmise that the morbidity and mortality in this group will prove to be somewhat higher than in the type of case previously done. It is questionable whether it is legitimate to accept this risk in cases with controlled lung disease in order to avoid the sequence of thoracoplasty and Schede. It seems to us that the procedure is definitely not indicated in the group of simple tuberculous empyemata with controlled lung disease in whom one can close the space in a high proportion of cases by simple thoracoplasty with frequent taps between and after every stage. In cases of simple tuberculous empyemata and the presence of uncontrolled parenchymal disease, the type of pathology of the lesion should govern the indication. If a lesion is such that it falls into the group where resection is generally accepted the presence of the empyema need not stand in the way. The same reasoning should apply to the mixed infection empyema case with controlled pulmonary disease. If the parenchymal lesion is of the type that should be resected, resection is feasible and legitimate in the presence of a mixed infection empyema. The latter, as has been shown, need not be an obstacle. In cases where the underlying lung is controlled or where the pathology seems to be of a type that does not fit the general indications for resection, we have followed the orthodox approach: Thoracoplasty followed by a Schede and a decortication of the lower portions of the lung, if these were free of parenchymal disease so as to allow re-expansion and obliteration of some of the dead space.

TABLE 3

Treatment and Fate of Cavities Uncollapsed by Thoracoplasty, March 1947 to March 1948.

	Case	Sputum after thoracoplasty	Type of secondary procedure			Comments	Sputum at present
1	M	++++	Revision				----
2	O	++++	Revision				----
3	S	++++	Revision				----
4	F	++++	Revision				----
5	R	++++	Revision				+-+-
6	D	++++	Revision			To recent for final evaluation	+-+-
7	V	++++	Revision			Improved but no complete conversion	--+-
8	Pa	++++	Revision	Cavernostomy		Sputum ++++ after revision converted after cavernostomy	----
9	Re	++++		Cavernostomy			--+-
10	P	++++	Revision		Lobectomy	Developed tuberculous wound infection and finally came to resection	----
11	Pe	++++	Revision		Pneumonectomy	Sputum ++++ after revision converted after resection	----
12	L	++++			Lobectomy	Excision after thoracoplasty resulted in conversion of sputum	----
13	T	++++			Pneumonectomy & Pleurectomy	Concommitant empyema	----
14	J	++++			Pneumonectomy	Extensive unilateral disease	----

The latter adjunct procedure has resulted in a considerable shortening of the time needed to obtain healing and closure of a pleurectomy wound.

Thoracoplasty Failures

In every service handling the surgical aspects of the treatment of pulmonary tuberculosis there accumulates a residual group of patients in whom thoracoplasty has failed to bring about the arrest of their disease. Disappointed and discouraged these patients present an important problem and challenge, both psychological and therapeutic. During the one year period 14 such patients have been encountered (Table 3).

Numerically the most important group is the one that was selected for revision operations. Ten such patients have been treated by a modified type of thoracoplasty revision combined with an open intrapleural freeing of the lung and a fixation of the apex in a lowered position by either some plastic procedure utilizing a pleural flap or a muscle transplant taken from the pectoralis group. This type of procedure has been chosen because revision alone in cases who had a technically satisfactory thoracoplasty to begin with, has been shown to result in only questionable improvement over the preceding thoracoplasty.

The question arises for what reasons a revision with apicolysis would appear to be preferable to resection. The former procedure has been elected in this group of cases on the following basis: After the pleural space has been entered and the upper portion of the lung has been freed the operator is in a position to palpate the lung and to correctly evaluate the pathology present. The value of such first hand information cannot be over-emphasized. In a certain number of cases it became apparent that there was sufficient elasticity present in the parenchyma to allow important shrinkage of the lung after lysis had been accomplished. In addition to this, other factors are to be taken into consideration and first amongst these is the presence or absence of a well developed interlobar fissure and the distribution of pathology throughout the lung. The important question to answer is whether a lobar resection is feasible or whether the situation will not permit anything less than a total pneumonectomy.

There have been instances where the wide distribution of the pathology and the history of some disease in the contralateral lung militated against even a lobectomy and would certainly have precluded the resection of a whole lung. In this type of case we have preferred to settle for a revision with apicolysis and fixation of the freed apex of the lung in a lower position.

Of the group of ten patients having undergone this type of

operation, five have had a prompt and complete sputum conversion. Of these four would fit the classification of apparently arrested with a negative sputum on concentrates and cultures for at least six months and on limited activity for at least a period of three months. The fifth case has been negative for only five months.

In this group there has been one complication, namely a tuberculous sinus formation in the wound and this has failed to close with streptomycin. This case ultimately came to resection (lobectomy) and has since done well.

In the remaining group of five, two patients have been markedly improved by the revision but still have an occasionally positive sputum. A third case has been operated on too recently to be classified. Two cases have been failures of the revision operation and have required additional surgery. One had a resection done and has made an uneventful recovery and has a negative sputum. In the second case resection was not felt to be feasible and a cavernostomy was performed. Drainage of the residual cavity resulted in sputum conversion and the wound was successfully closed by a muscle flap implant. Of the original group of ten thoracoplasty failures treated by a modified revision, two or 20 per cent have been failures. Both had to have additional surgery. One case is too recent to be classified. Two patients, or 20 per cent, are improved but have not obtained a complete conversion of their sputum. They may still require further treatment. Fifty per cent had sputum conversion.

The remaining group of four thoracoplasty-failures not treated by revision have been managed as follows: One elderly patient in whom major surgery was precluded was treated by a cavernostomy. The remaining three patients have been treated by resection and have made uneventful recoveries. Their sputum is negative on concentrates and cultures.

Thus, of the total group of 14 thoracoplasty failures, ten patients ultimately had a good result with complete conversion of sputum after various types of surgery or combinations thereof. Two have been improved, but not completely arrested by revision. One is too recent to be classified and one has been improved by a cavernostomy. This leaves three out of 14 cases in whom management of thoracoplasty failure ended in a questionable or unsatisfactory result.

SUMMARY

The surgical therapy in pulmonary tuberculosis at a Veterans Administration chest center (Castle Point), has been described with a discussion of indications and results of various procedures.

Stress has been placed on recent additions to the field including:

1) Indications for open pneumonolysis.
2) Surgical intervention for the establishment of a pneumothorax space in cases in whom attempt at pneumothorax was unsuccessful.
3) Revision of thoracoplasty with intrapleural pneumonolysis.
4) Thoracoplasty performed from below upwards.
5) Combined pneumonectomy and pleurectomy.

RESUMEN

Se ha descrito la terapia quirúrgica de la tuberculosis pulmonar en un Centro Torácico de la Administración de Veteranos (Castle Point), y se han discutido las indicaciones y los resultados de los varios procedimientos. Se ha hecho hincapié sobre las recientes adiciones a este campo, inclusive de:

1) Las indicaciones para la neumonolisis abierta.
2) La intervención quirúrgica para establecer un espacio neumotorácico en aquellos casos en los que fraçasó la tentativa del neumotórax.
3) La revisión de la toracoplastia con neumonolisis intrapleural.
4) La toracoplastia llevada a cabo de abajo hacia arriba.
5) La neumonectomía y pleurectomía combinadas.

Stomatitis and Dermatophytosis Coincident to Streptomycin Therapy

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Four cases of streptomycin stomatitis are presented together with three cases of eczematous dermatitis of the hands and feet coincident with streptomycin therapy, and attention is called to association of stomatitis with a vulvar mycotic lesion in one instance and concomitant stomatitis with severe trichophytoid lesions of hands and feet in another.

While the over-all series of treatment with streptomycin at this institution embraces a period of 28 months and 130 cases, it is notable that the pharyngeal ulcers to be described occurred relatively rarely in this series. Recrudescence of *pre-existing* trichophytosis was observed while the patient was undergoing streptomycin therapy. In each of the severe cases of eczematoid dermatitis to be described, a pre-existing trichophytosis of the feet was noted. In the light of the history of previous fungus infection, it is perhaps not illogical to infer that streptomycin therapy tends, in some cases at least, to give impetus to the trichophytosis already present.

Case 1: Pharyngeal and vulvar ulceration: W.C., a 22 year old white woman was admitted to Mississippi State Sanatorium on June 30, 1947. Admission diagnosis was bilateral, far advanced pulmonary tuberculosis. Auscultation revealed coarse, post-tussic rales throughout the right lung and expiratory wheeze over the subclavicular area. Coarse rales throughout left chest during both phases of respiratory cycle. Dullness to percussion was elicited at the level of the fourth rib anteriorly on right and an impaired note from the sixth to the ninth rib posteriorly on left side. Roentgenograms disclosed bilateral perihilar and mid-lung field infiltration, with fine feathery mottling of lung fields bilaterally almost through their entirety.

Streptomycin therapy was instituted on July 1, 1947, consisting of 2.0 grams daily parenterally and 0.5 gram by inhalation. A total of 85.0 grams was given. Blood counts, urinalyses and N.P.N. determinations were done periodically throughout the course and were within normal limits.

Pharyngeal ulcers were noted on August 25, 1947 (after 78.0 grams had been given). The ulcers were initially observed on the anterior pillars, the buccal mucous membrane, sublingually and on the vermilion border of the lips. Initially, they appeared as white two to four millimeter vesiculations which within 36 hours broke down to form five to eight millimeter craters eventually covered with shaggy, dirty white membrane.

Small vesicles appeared at the corners of the mouth and broke down to form fissures.

Smears taken repeatedly disclosed no specific organism. To prevent spirochetal infection, the membrane was removed from the ulcers and 10 per cent neo-arsphenamine in glycerin was applied topically followed by perborate mouth washes. Within 72 hours of the initial pharyngeal ulceration, vulvar ulcers following vesiculation were noted. Laboratory examination disclosed monilia and 2 per cent gentian violet was applied topically. Streptomycin was discontinued on September 5, 1947. Treatment of the lesions continued as above for 12 days. The ulcers, pharyngeal and vulvar healed. Re-institution of streptomycin (1.5 grams) resulted in recurrence of ulcers which again disappeared upon stopping streptomycin.

Case 2: Pharyngeal ulceration: R.F., a 21 year old white woman was admitted to this Sanatorium on June 4, 1948. Prior to admission she had right artificial pneumothorax for 14 months, inadvertently re-expanded. Immediate pre-admission history was that of easy fatigability, persistent cough with moderate expectoration. Intermittent hoarseness for preceding 90 days. Small hemoptysis one month prior to entrance. Rhonchi were heard in sub-clicular and inter-scapular areas on the right side. The findings were normal on the left side. A roentgenogram disclosed evidence of fibro-exudative lesion extending from apex to second intercostal space anteriorly on right side. No unusual density was seen on the left side.

Bronchoscopy on June 17, 1948 revealed "considerable amount of granulation tissue near the carina . . . . lumen of trachea reduced to about one-half its normal size." (Subsequent bronchoscopy revealed the right primary bronchus to be partially stenosed by granulation tissue). The patient was started on streptomycin on July 3, 1948. Thirty-one grams had been given by August 7 when vesiculations like those described in the previous case were noted. (She had been requested to report all paresthesias in the mouth). Although streptomycin was discontinued immediately, the lesions went on to crater formation within 48 hours. Neo-arsphenamine topically was used as in Case 1. The lesions cleared in five days. On August 12 streptomycin was re-started in 100.0 milligram doses. On August 14 (within 48 hours) vesicles and ulceration again appeared. (Total of 0.75 gram given). Faucial, buccal, sublingual and vermilion border of lips were the sites involved. This time the ulcerations persisted 10 days.

Because a successive bronchoscopy disclosed the lesion (tracheal) to be progressing after an original regression due to the streptomycin, the bronchoscopist felt that streptomycin was the only recourse. Streptomycin was again administered on September 23, 1948. After 333.3 milligrams there was a return of vesicles, generalized capillary dilatation over the body-surface, peri-orbital oedema plus angio-neurotic oedema of the lips. The temperature was recorded at 102.4 degrees F. The patient complained of intense burning sensations over the entire body and paresthesia and burning in the pharynx. Pyribenzamine (50.0 millagrams) resulted in subjective relief from burning sensations. Erythema of body was reduced and oedema of the lips disappeared gradually. Only two 5.0 millimeter ulcerations in the pharynx were seen and these disappeared in 72 hours.

Case 4: Pharyngeal ulceration: S.D.L., a 16 year old white female was admitted April 21, 1948 with moderately advanced disease with a pronounced exudative component. Roentgenographically, soft mottling from the apex to the horizontal fissure was seen on the right side and a cavum one centimeter in diameter at the level of the first rib anteriorly. Two one by one centimeter exudative lesions in the first and second intercostal spaces respectively appeared on the left side. Right artificial pneumothorax was unsuccessful. Streptomycin was begun on April 26 at daily dosage of one gram and continued until August 24. The streptomycin was discontinued at this time because of the appearance of pharyngeal ulceration as described in preceeding cases. At this time a total of 90.0 grams had been given. An attempt to re-start streptomycin resulted in re-appearance of the ulceration. Subsequent discontinuance of streptomycin resulted in healing of the pharyngeal lesions. It has not been the writer's experience that pyribenzamine prevents a second appearance of pharyngeal ulcers; i.e., once streptomycin has been discontinued because of onset of ulcers, and is subsequently re-started. In this case the sputum was converted and remains negative as of September 25, 1948; the roentgenograms had shown excellent clearing of the exudative lesion.

Case 4: Pharyngeal ulceration: A.K.M., a 34 year old white male was admitted on May 29, 1948 with history of persistent cough (three months) and minimal expectoration. Chest examination disclosed no abnormal findings. A roentgenogram revealed peribronchial infiltration in lower one-half of left lung field. Sputum was Gaffky iv. Bronchoscopy on June 17 disclosed tuberculous bronchitis of left lower lobe bronchus without visible ulceration.

Streptomycin was begun April 21 with one gram daily. After 87.0 grams on October 7, a shaggy white membrane was seen over the aperture of Stenson's duct which was treated locally with neo-arsphenamine. Streptomycin was discontinued. Smears cultured on Sabouraud's medium were uninformative. The crater surrounding the opening of Stenson's duct healed in five days after discontinuance of streptomycin. Concurrent sublingual and vermilion lip border lesions also healed. The lesions re-occurred on re-starting streptomycin. Successive bronchoscopies have revealed that the bronchial lesion in the left lower lobe has improved markedly.

Case 5: Recrudescence of dermatophytosis: W. de L., a 40 year old white man was admitted on May 14, 1946 with positive sputum and an infiltrative lesion confined to left apex roentgenographically. Left pneumothorax was instituted. Ineffective closed pneumonolysis was done on February 3, 1947. Inasmuch as the cavity would not close, pneumothorax was abandoned and he came to three stage thoracoplasty begun October 27, 1947 and completed December 16.

Between the first and second stages, the patient was highly febrile for several days. A check film disclosed widespread apparently tuberculous disease on operative side. Bronchoscopy at this time revealed no blockage of major bronchi. Streptomycin was begun November 5, 1947 at 2.0 grams daily in hope of controlling disease in ipsilateral side and prevention of spread to contra-lateral lung. The patient's temperature approached normal and a check-film showed marked clearing. The second stage was done on November 25 and the third was finished as mentioned.

The course of streptomycin was continued until 145.0 grams had been given. At this time eczematous weeping lesions of hands were noted. Initially the lesions were vesicles which ruptured to liberate clear fluid. In later stages the overlying skin became undermined, sloughed and the corium was exposed. The skin sloughed from the terminal phalanges of the index, middle and ring finger of the right hand. The thumb had weeping lesions of lesser intensity. Boracic acid soaks, Lassar's Paste to the denuded areas plus touching up of ruptured vesicles with 2 per cent silver nitrate was accomplished. Streptomycin was discontinued at 145.0 grams.

The aforementioned lesions did not abate in intensity for four weeks. Questioning and examination of the patient revealed trichophytosis of feet admittedly present eight years. (Organism identified by laboratory examination). When the lesions were subacute, quinine bisulphate was used as powder. The lesions of the hands and feet were healed completely in eight weeks. This and the two succeeding cases had similar histories of co-existent dermatophytosis of the feet with comparable reactions under streptomycin therapy and are therefore listed.

Case 6: Recrudescence of dermatophytosis: P.B., a 42 year old white man was admitted to Mississippi State Sanatorium on April 16, 1948 with a diagnosis of far advanced bilateral pulmonary tuberculosis. Roentgenograms disclosed evidence of fibro-caseous disease with loculations, embracing the upper two-thirds of the left lung field. On the right side a 3.0 by 3.5 centimeter cavity was seen in the apex and fibro-caseous disease extending from the apex to the second intercostal space anteriorly. A tracheo-bronchial lesion was discovered on early bronchoscopy. Pneumothorax on the left side was unsuccessful (endobronchial lesion noted on right).

Streptomycin was begun May 26, 1948 with 1.0 gram daily. This was discontinued August 28 after 81.0 grams had been administered. On August 25 an eruption of vesicular nature was noted on the hands. The vesicles ruptured and proceeded to weeping eczematoid type lesions involving three digits on the left hand. Coincident dermatophytosis of feet was present prior to streptomycin therapy and exacerbated during the course of treatment. There was previous history of chemical (paint factory) dermatitis three years before. Remedial measures previously mentioned were used topically. Pyribenzamine was ineffective. In this case as in the fore-going, the existent dermatophytosis on the feet became worse during streptomycin therapy. At this point, it must be mentioned that contact of hands and feet is unavoidable and is a factor. The emphasis, however, is on the recrudescence of the lesions.

Case 7: Pharyngeal ulceration and recrudescence of dermatophytosis: J.H.R., a 58 year old white man was re-admitted May 10, 1948 with far advanced bilateral disease. A complicating vocal cord ulcer and an epiglottic implant were the indications for streptomycin. The roentgenograms disclosed evidence of fibro-caseous infiltration of the upper one-half of both lungs and basal emphysema. Streptomycin was begun on May 17 at 1.0 gram daily; discontinued August 23 after a total of 92.0 grams had been given.

After 88.0 grams of streptomycin, it was noted that a dermatophytosis of the feet (present for 12 years) was progressively worse. Vesiculations which ruptured to leave superficial slough, were followed by beefy red,

weeping lesions of both feet. The existent dermatophytosis of the toes spread to involvement of one-half of the dorsum of each foot. Treatment locally as outlined previously was ineffectual. Resort to 2 per cent aluminum acetate proved more efficacious. Pyribenzamine was given in doses of 200.0 milligrams daily for two weeks.

After 90.0 grams of streptomycin, pharyngeal ulceration as in previous cases was noted. Marked fissuring of the mouth borders was also noted as in the first case cited. Subjective improvement of hoarseness and objective improvement of epiglottis and vocal cord lesions were noted. Streptomycin was continued until a total of 92.0 grams was given.

The dermatophytosis grew progressively worse with denudation and extremely slow re-epithelialization. The pharyngeal ulceration in this case progressed until the craters measured 8.0 millimeters in diameter. The objective in this case was achieved in that the eiglottic and vocal cord lesions healed. The pharyngeal lesions healed 18 days after onset (14 days after stopping streptomycin). The dermatophytosis healed 90 per cent after 12 weeks. Associated vestibular disturbance (vertigo) persists at present writing, nine weeks after streptomycin was discontinued.

Commentary

Observation of these complications of streptomycin therapy leads to the consideration of the following points: (1) Streptomycin reduces bodily resistance to pre-existing fungus infections (vid. trichophytosis) giving added impetus to these entities. Close observation is indicated when giving streptomycin in these cases. (2) Caution is called for in administering streptomycin to women with vaginal tract fungaceous infestations of any degree (vid. case 1). (3) Until further work with pharmaceuticals calculated to minimize streptomycin reactions, particularly stomatitis, proves efficacious, streptomycin had best be discontinued when such complications occur. Repeated efforts were made to re-start streptomycin in fractional doses with and without pyribenzamine to no appreciable avail.

SUMMARY

1) Four cases of pharyngeal ulceration occurring during streptomycin therapy are presented.

2) Three cases of recrudescence of pre-existing dermatophytosis are recorded.

3) One case was a combination of pharyngeal ulceration and vulvar ulceration.

4) One case represented combined pharyngeal ulceration and dermatophytosis.

RESUMEN

1) Se presentan cuatro casos de ulceración faríngea que ocurrieron durante el tratamiento con estreptomicina.

2) Se señalan tres casos de recrudecimiento de dermatofitosis pre-existente.

3) En un caso hubo coexistencia de ulceración faríngea y vulvar.

4) En un caso hubo ulceración faríngea y dermatofitosis.

REFERENCES

1 Beham, H. and Perr, H.: "Stomatitis Due to Streptomycin," *J.A.M.A.*, 138:496, 1948.

2 Hinshaw, H. C.: "Tuberculosis Research Project Report," *Am. Rev. Tuberc.*, 56:168, 1947.

3 Canada, R. O.: "Streptomycin Therapy in Progressive Tuberculosis," *Am. Rev. Tuberc.*, 56:508, 1947.

4 D'Esposo, N. and Steinhaus, J.: "Streptomycin Therapy," *Am. Rev. Tuberc.*, 56:589, 1947.

5 Heilman, D. and Hinshaw, H. C.: "Toxicity of Streptomycin," *Proc. Staff Meet., Mayo Clinic*, 20:408, 1945.

6 Barnwell, J. and Bunn, P.: "Report of 223 Patients Treated with Streptomycin," *Am. Rev. Tuberc.*, 56:485, 1947.

7 Farrington, R. and Hull-Smith, H.: *J.A.M.A.*, 134:679, 1947.

Hydrothorax, Ascites, and Pelvic Endometriosis
Report of a Case

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The syndrome of ascites, hydrothorax, and benign ovarian fibroma has been well recognized since Meigs' classical report[1] in 1937. Others[2] have noted a similar picture in the presence of other types of ovarian tumors, twisted ovarian cyst, and uterine fibroids. Some[3] contend, however, that the term "Meigs' syndrome" should be applied only if a solid benign tumor of the ovary is found.

We recently had occasion to study a young woman with pelvic endometriosis in whom pleural effusion and ascites directly followed laparotomy. The possible relation between this occurrence and Meigs' syndrome is of interest and we are reporting the case herewith.

The patient, a 32 year old white housewife, was first admitted to Emanuel Hospital, Portland, Oregon, on May 22, 1944. She had had rather severe menorrhagia and dysmenorrhea since the menarche at 14 years of age, and at the time of menses had noted gradually increasing pelvic pain on straining at stool, urinary frequency and dysuria, and anorexia which was sometimes associated with nausea and vomiting.

She had had scarlet fever at the age of five, and one year later a "severe kidney infection" lasting two or three months. In 1937 when six months pregnant she was hospitalized for eight weeks because of toxemia. Uterine hemorrhage due to placenta previa occurred, and she was delivered spontaneously of a stillborn baby six weeks after admission.

Physical examination in May 1944, showed her to be small but well nourished. The presence of a systolic murmur heard at the apex and mitral area was recorded at this time but not on any subsequent admission. Pelvic examination showed the uterus to be adherent posteriorly, little if any enlarged, but with marked bilateral nodularity, palpable chiefly on rectovaginal examination. This area posteriorly was intensely sensitive to palpation, particularly near the time of her menstrual periods. The induration was more pronounced on the left and here a sense of cystic enlargement could be elicited.

At laparotomy on May 23, 1944, the retroverted uterus was found to be rather densely adherent to the sigmoid colon. The appendix was involved in an endometrial growth and there were a few endometrial nodules on the uterine fundus and on the peritoneal reflection of the bladder anteriorly. The left ovary contained a small cyst. Subtotal hysterectomy, appendectomy, and removal of the left tube and ovary were performed. The pathologist, Dr. H. H. Foskett, reported endometriosis on the surface of the uterus, appendix, and left ovary. The latter contained a corpus luteum cyst. Endometrial hyperlasia with areas of

hemorrhage was present in the uterine canal. Recovery was uneventful and the patient was discharged on June 4, 1944.

In July 1944, she began to have dyspareunia and lower pelvic pain. Rectal bleeding and discomfort on defecation occurred at the time of expected menses, and became more severe in January 1945. Vaginal examination showed numerous nodular growths in the cul-de-sac, one of which was about 4 cm. in diameter. She was admitted to the hospital on February 3, 1945, where 50 mg. of radium was implanted in the cervical canal for a total of 2,000 milligram hours of radiation. This therapy was carried out for the purpose of eliminating ovarian activity, which definitely was responsible for the continuation of the endometriosis process.

Her pelvic pain and other symptoms were much less for the following year. Early in 1946, however, monthly cramping pain again became severe, and urinary frequency, dysuria, urgency, and nocturia recurred, together with episodes of anorexia, nausea, and vomiting.

These symptoms led to her third hospital admission on July 10, 1947. Physical examination revealed a midline lower abdominal scar and tenderness in the left lower quadrant to moderate palpation. The external genitals were palpably and visibly free of pathology. The vagina was normal, but on rectovaginal palpation the utero-sacral ligaments were found to be intensely sensitive and slightly nodular, but much less indurated and smaller than on previous occasions. No adnexal pathology could be determined. It was felt that ovarian activity had not been completely abolished and that it was necessary that this be brought about in order to alleviate any hormonal effect on the endometrial lesion. More radium therapy seemed inadvisable. Deep x-ray therapy was ruled out because of a rather irritable bowel. Hence surgical removal of the ovary seemed to be the reasonable and most logical choice. Routine examination of the blood and urine was normal except for the finding of diacetic acid and occasional pus cells in the urine. The blood serology was negative.

Laparotomy was performed under cyclopropane-curare anesthesia on July 11, 1947. An adhesion between the omentum and upper abdominal wall was divided but no other adhesions or active endometrial lesions were evident. The right ovary and tube were removed and the area peritonealized. This ovary was situated rather high on the right lateral pelvis and was moderately adherent. No other visible or palpable pathology was seen in the lower abdomen. The upper abdomen was not examined.

Examination of the specimen showed the tube to be normal. There were a few areas of discoloration with scar formation and hemorrhage on the surface of the ovary. Sections showed a number of endometrial transplants and several zones of pigment accumulation in the cortex. There was also a small zone of fibroblastic proliferation containing a few small lymphocytic aggregations in the ovarian stroma. Study of many sections did not reveal any evidence of ovarian fibroma or Brenner's tumor.

The early postoperative course was marked by considerable nausea, vomiting, and generalized abdominal pain and distention. On July 15th, the 4th postoperative day, the patient awoke short of breath. Examination showed signs of a large right pleural effusion.

Next day, 500 cc. of clear fluid was withdrawn. This contained 50,000

red blood cells and 700 white blood cells per cubic centimeter, of which 57 per cent were lymphocytes and 43 per cent polymorphonuclear neutrophiles. The protein content was 0.96 per cent. Cultures of the fluid for tubercle bacilli and other organisms showed no growth. The centrifugated sediment was examined by the pathologist, who reported many lymphocytes, numbers of large mononuclear cells with hyperchromatic nuclei, others of fibroblastic origin, and a few hyperchromatic polynucleated cells. No definite tumor cells were found. About 1,800 cc. of fluid was removed on July 18th, with marked improvement in her dyspnea. The cell count of this specimen was much the same as the first.

There was no reaction to the intracutaneous injection of 0.005 mg. of PPD or to 1 mg. of old tuberculin.

The patient left the hospital against advice on July 31, and came to the office in a wheel chair for thoracenteses. She continued to have a slight non-productive cough, temperature elevations to 99 degrees F., occasional pleuritic pain on the right, intermittent nausea and vomiting, episodes of mild diarrhea, abdominal soreness and distention, lumbar backache, weakness, and some urinary frequency, dysuria, and urgency. There was also recurrent upper abdominal pain usually half an hour meals, associated with heartburn and belching. Her appetite remained poor and small doses of insulin were given before meals with little improvement. Therapy consisted of an amino acid concentrate, high protein diet, and symptomatic treatment of her abdominal distress. Perhaps unwisely, several oral doses of stilbestrol were given early in August because of troublesome nervousness and hot flashes. It was discontinued because she felt it increased her nausea.

Examination on August 8th showed her abdomen to be somewhat enlarged with flatness to percussion in the flanks and a fluid wave on palpation. She had gained weight from 97 to 103 pounds, presumably due to ascites. No edema of the face or ankles was present. The blood at this time contained 11.9 g. of hemoglobin. There were 4.45 million red blood cells and 12,250 white blood cells per cubic millimeter. The differential white cell count showed 85 per cent neutrophile and 4 per cent eosinophile polymorphonuclear leukocytes, 6 per cent lymphocytes, and 5 per cent monocytes. The sedimentation rate (Westergren) was 81 mm. in 45 minutes. Urinalysis was negative except for 10 to 20 white blood cells per high power field in the voided specimen.

Thoracenteses were performed three times a week on the average until August 27, 1947. The amounts of thin, yellow, slightly turbid fluid withdrawn varied from 500 cc. to 1,950 cc., and averaged 1,200 cc. There were 4,550 white cells per cubic millimeter on July 25, with 88 per cent lymphocytes and 12 per cent neutrophiles. On August 15, the count was 1,225 per cubic millimeter with 65 per cent neutrophiles, 20 per cent lymphocytes, and 15 per cent monocytes. The final specimen on September 26, contained only 300 cells per cubic millimeter with a similar differential count. The sediment obtained from centrifugating the pleural fluid was examined on several occasions. Each time, lymphocytes, eosinophiles, granulocytes, monocytes, erythrocytes, and endothelial cells were found, but nothing indicating malignancy was reported.

The patient was fluoroscoped before and after each thoracentesis, and roentgenograms of the chest were made every two or three weeks. No lesion in the lungs was demonstrated.

On August 25, 3,500 cc. of thin, clear yellow fluid having the characteristics of a transudate was removed from the abdomen. The path-

ologist reported the cellular elements to be like those in the pleural fluid. The blood serum protein was 7.2 per cent with 3.9 g. of albumin and 3.3 g. of globulin.

Two doses of Salyrgan-theophylline were given intravenously and restriction of salt and fluids was advised. After thoracentesis of 1,000 cc. on August 27, her weight was 92 pounds. Her symptoms now gradually improved and she began to gain weight and strength.

The pleural effusion reappeared late in September, and what proved to be the last chest aspiration was performed on September 26, when 1,550 cc. of fluid was withdrawn. Examination showed the liver edge to be 2 cm. below the costal margin in the midclavicular line. There was some lower abdominal tenderness and dullness on the left side of the abdomen, but no free fluid was apparent. Subsequent fluoroscopy and roentgenograms of the chest showed the lungs to be normal.

During November and December 1947, there were occasional mild episodes of diarrhea, several hot flashes a day, infrequent twinges of pain in the right lower chest, and occipital headaches with nausea two or three times a week. Her weight was 101½ pounds and blood pressure 154/104. Examination of the heart and lungs was negative and the abdomen showed only slight tenderness in the lower portion. The blood on December 12 showed 10.5 g. of hemoglobin and 3.98 million red blood cells and 6,750 white blood cells per cubic millimeter (80 per cent neutrophiles). The sedimentation rate was 95 mm. in 45 minutes. Urinalysis was negative.

When the patient was seen in June 1948, almost a year after her second laparotomy, she had no symptoms except for occasional two or three day episodes of mild lower abdominal pain once or twice a month, occasional loose stools, and infrequent hot flashes. Her weight was 110 pounds and her strength and appetite were good. There was slight lower abdominal tenderness, with "doughiness" on the left side but no apparent fluid, masses, or enlargement of the liver or spleen. The roentgenogram of the chest showed no abnormalities. The sedimentation rate was 22 mm. in 45 minutes. A bromsulfalein test showed 6 per cent retention of the dye after 45 minutes.

An examination by an internist in February 1949, showed no evidence of recurrence of her ascites or hydrothorax. Her general condition had remained good.

Thanks are due to Drs. Foskett, Keane, and Conklin for their help with the management of this patient.

SUMMARY

In summary, this 32 year old patient had had prolonged symptoms of endometriosis, temporarily improved by subtotal hysterectomy and removal of the left tube and ovary in 1944, and by radium implantation in the cervix in 1945. At laparotomy on July 11, 1947, the other ovary (which showed endometrial implants) was removed. Four days after operation the patient developed a severe pleural effusion persisting for six weeks and requiring 20 thoracenteses. Ascites appeared a month after operation and one paracentesis was performed. Effusion into the peritoneal and right

pleural cavities ceased abruptly late in September, 1947, six weeks after laparotomy, and has not recurred.

The basis for sudden onset and disappearance of these effusions is not known. A tuberculous etiology is quite unlikely in view of the negative tuberculin tests. The clinical findings do not suggest cardiac decompensation, hepatic or renal failure, or hypoproteinemia. Metastatic malignancy in the thorax and abdomen can also be ruled out. It is true that two cases with endometrial metastases to the lungs have been reported,[4] but ascites and pleural effusion were not present in these patients. Our case is not presented as an example of Meigs' syndrome, but the similarity to reported instances of this condition is striking enough.

RESUMEN

En resumen, esta enferma de 32 años de edad, ha tenido síntomas prolongados de endometriosis temporalmente mejorada por la histerectomía subtotal y extirpación de la trompa izquierda y del ovario del mismo lado en 1944 y por la implantación de radio en el cervix en 1945. En la laparotomía en Julio de 1947, el otro ovario (que mostraba implantación endometrial) fue extirpado. Cuatro días después de la operación, la enferma tuvo un derrame severo pleural, persistiendo durante seis semanas que fue motivo de 20 toracénteses. La ascitis apareció un mes después de la operación y se practicó una punción. El derrame dentro del peritoneo y de la cavidad pleural derecha cesó bruscamente a fines de Septiembre de 1947, seis semanas después de la laparotomía y no ha recidivado. La causa de la aparición repentina y la desaparición brusca de estos derrames no es conocida.

Una etiología tuberculosa no es justificable en vista de las reacciones negativas a la tuberculina. Los hallazgos clínicos no sugieren descompensación cardiaca ni insuficiencia renal o hepática ni hipoproteinemia. Una metástasis maligna en el tórax o en el abdomen también puede descartarse. Es cierto que otros dos casos con metástasis endometriales en el pulmón se han referido. Pero la ascitis y el derrame pleural no se presentaron en estas enfermas.

Nuestro caso no es presentado como un ejemplo de síndrome de Meigs, pero la similaridad de esta condición con los casos referidos es bastante notable.

REFERENCES

1 Meigs, J. V. and Cass, J. W.: "Fibroma of the Ovary with Ascites and Hydrothorax with a Report of Seven Cases," *Am. J. Obs. and Gyn.*, 33:249, 1937.

2 Calvenson, M., Dockerty, M. B. and Bianco, John J.: "Certain Pelvic Tumors Associated with Ascites and Hydrothorax," *S. G. and O.*, 84: 181, 1947.

3 Simon, Herbert J.: "Meig's Syndrome: A Case Report and a Review of Recently Published Cases," *Am. J. Obs. and Gyn.*, 53:1042, 1947.

4 Goodall, James R.: "A Study of Endometriosis," *J. P. Lippincott Co.*, Philadelphia, 1943, pages 50-60.

Tuberculosis Control in Ohio State Reformatory

(1) With Comparative Study of Two Year Periods.

(2) With Survey of Penal Institutions in the United States and Canada.

(3) With Recommendations for More Complete Control Measures.

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Introduction

In the August, 1947 issue of the Ohio State Medical Journal, the authors described the tuberculosis control measures followed at Ohio State Reformatory. The medical director of the reformatory initiated a tuberculosis control program at that institution January 1, 1944, by routinely x-raying all admissions and re-x-raying all for whom it was indicated, by isolating all active cases of tuberculosis, and by using collapse therapy in those for whom it was indicated. The statistical results of this control procedure was reported at the end of two years and a study of state needs, together with recommendations, were made.

Since this is an institution of relatively short periods of incarceration, the average being 18 months, these control measures would readily manifest results. The statistics of another two year period have accumulated and have been compiled for comparison with those of the first two years.

For clarity in the present paper, the control measures at Ohio State Reformatory are described again. Inmates upon admission to this institution are placed in isolation and while there are given a complete history, physical and psychiatric examinations and also an x-ray inspection of the chest. Those inmates who show need for further observation are followed as may be indicated and those who are found to have tuberculosis are placed in the hospital. The definitely active cases are isolated in separate wards and when they become non-infectious, they are transferred to a convalescent ward. When the patients progress further in the cure, they are placed on a convalescent range and have the run of an isolated section of the prison yard during certain specified times. They continue under hospital supervision and receive special diets, vitamins, and anti-anemic medication.

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While under treatment, the patients receive bed rest. Artificial pneumothorax, thoracoplasty, and other surgical collapse procedures are used in those cases in which it is indicated.

After the patients become apparently arrested and discharged to light outdoor assignments, they are called in at six week intervals for a review of temperature, pulse, and weight . . . and x-rayed as may be indicated.

Continuation of Control Procedures of 1944-45

The above quotation also describes the control procedure followed during 1946 and 1947. A definite effort has been made to make all facilities available for control purposes as useful as possible. Tuberculosis was constantly kept in mind and patients were x-rayed and re-x-rayed as indicated. It was felt that a day by day consciousness of tuberculosis is better than routine x-ray surveys of six to 24 month intervals, if not integrated with a planned program. Routine surveys at intervals may be sufficient after a definite control procedure has been established in each institution with adequate provision for isolation, treatment, and rehabilitation.

Control Measures in Other Institutions

A survey of penal institutions in the United States and Canada was made. Seventy-three State, 21 Federal, and 10 Canadian penal institutions were sent a questionnaire covering the four phases of a tuberculosis control program. Answers were received from 55 State, 17 Federal, and six Canadian institutions. This is a representative group of institutions and should give some idea of the control measures in the penal institutions in general.

Procedures Used in Tuberculosis Case-Finding in Penal Institutions

Questionnaires, 104; Answers, 78

METHOD OF CASE-FINDING	State	Federal	Canadian	Total
Physical Examination	44	15	4	63
Tuberculin Test	10	3	0	13
Fluoroscopic Examination	6	5	0	11
X-Ray, Small Film	6	8	3	17
X-Ray, Large Film	25	5	1	31
Sputum Examination	16	7	1	24

Fifty-four institutions answering the questionnaire stated they had a case-finding program, but in an analysis of the answers to all questions, it is apparent that only a few have a case-finding

program that is continuously, day by day, searching for new cases of tuberculosis. Physical examination which is inaccurate is the most frequent diagnostic procedure used. X-ray inspection by the large film technique is the next most frequent procedure used. This is used only when indicated and none stated it was used on all admissions.

Mass x-raying by the small film technique was used in 17 institutions. It was more frequently used in Federal institutions than State. It was used semi-annually to every two years and was generally brought in at the discretion of some outside agency. There was nothing to indicate that this procedure was integrated with any organized method of tuberculosis control within the institution. There are various other methods of case-finding in some institutions which also are not linked with a planned program.

Isolation Procedures Used in Penal Institutions

Questionnaires, 104; Answers, 78

ISOLATION USED	State	Federal	Canadian	Total
Tuberculosis Ward in Penal Hospital	32	5	4	41
General Penal Hospital	2	0	0	2
Special Tuberculosis Hospital				
For Penal Patients	12	13	1	26

Forty-one institutions isolated their tuberculosis patients in a special ward in the general penal hospital. Two isolated their tuberculous in the general penal hospital. Twenty-six institutions had a special tuberculosis hospital for isolation of their patients. The federal institutions all send their tuberculous patients to the Medical Center for Federal Penal Institutions at Springfield, Missouri. Although the Federal Penal Institutions have the advantage of being able to remove their tuberculous cases to the Medical Center in Missouri, when diagnosed, there is nothing to indicate that the case-finding method in Federal Institutions is superior to that in State institutions except the more frequent use of mass x-ray surveys. Twelve State institutions and one Canadian had special hospitals for their tuberculous patients.

Upon closer inspection and analysis of the questionnaire in regard to isolation procedures in the different states it appears that in 23 states the tuberculous patients are isolated in a tuberculosis ward of the penal hospital. Not more than eight states have a special tuberculosis hospital for the penal tuberculous. Five states send their tuberculous patients to the State Sanatorium. Two states have a large special ward in the hospital of

one of their penal institutions. Two states put their tuberculous patients in the general penal hospital. An occasional institution will obtain a parole for a tuberculous patient and return the patient to the county authority for treatment.

Treatment Procedures Used in Penal Institutions

Questionnaires, 104; Answers, 78

PROCEDURES	State	Federal	Canadian	Total
Bed Rest	41	9	5	55
Pneumothorax	17	1	2	20
Thoracoplasty	10	0	1	11
Phrenic	11	1	2	14
Pneumoperitoneum	9	1	0	10
Intrapleural pnumonolysis	5	1	0	6
Extrapleural pneumonolysis	7	0	1	8
Dietary Consideration	28	1	5	34

Bed rest is commonly used in the treatment of these cases in the various institutions. Many give their patients special dietary consideration. Collapse procedures are occasionally used and probably to the extent that specialists or consultants are available or special tuberculosis hospitals.

Only 20 answering stated they had a rehabilitation program and only four institutions stated they planned a program. This appeared to be the weakest link in the tuberculosis control chain, and quite naturally would be the last developed program.

Statistics for 1946-47 at Ohio State Reformatory

From January 1, 1946 to January 1, 1948, the same case-finding program was followed as in the two previous years. During this two year period, 2424 committments had routine chest x-ray inspection with subsequent follow-up of those in whom it was indicated. Of these, 1678 inmates were white and 746 were colored. Fifty-two cases were diagnosed as having tuberculosis of which 40 were active and 12 healed. Of these, 33 were white and 19 were colored. Four white had pleurisy with effusion, and one white and three colored had primary tuberculosis.

Of the total x-rayed, 2.1 per cent had tuberculosis in some form excluding healed primary lesions. Active tuberculosis 1.65 per cent; inactive tuberculosis 0.49 per cent. Thirty-three or 1.96 per cent of the whites had tuberculosis of which 27 or 1.6 per cent had active tuberculosis. Nineteen or 2.57 per cent of the colored had tuberculosis of which 13 or 1.74 per cent were active. Six or 0.3 per

cent of the white and six or 0.8 per cent of the colored had inactive tuberculosis.

The following tables give the number and percentage of the active and healed cases of tuberculosis in the different classifications and by race.

White Inmates

CLASSIFICATION	ACTIVE No.	ACTIVE Per cent	INACTIVE No.	INACTIVE Per cent
Minimal	13	39.4	4	12.12
Moderately advanced	8	24.24	1	3.03
Far advanced	1	3.03	1	3.03
Pleurisy with effusion	4	12.12	0	0
Primary	1	3.03	0	0
TOTAL	27	81.82	6	18.18

Colored Inmates

CLASSIFICATION	ACTIVE No.	ACTIVE Per cent	INACTIVE No.	INACTIVE Per cent
Minimal	2	10.53	5	26.32
Moderately advanced	7	36.84	1	5.26
Far advanced	1	5.26	0	0
Pleurisy with Effusion	0	0	0	0
Primary	3	15.79	0	0
TOTAL	13	68.42	6	31.58
GRAND TOTAL	40	76.92	12	23.08

Comparison of Statistics of Years 1946-47 with those of 1944-45

	1944-45	1946-47
Total Inmates	2419	2424
White	1665	1678
Colored	754	746
Active Tuberculosis (White)	29	27
Active Tuberculosis (Colored)	23	13
Inactive Tuberculosis (White)	28	6
Inactive Tuberculosis (Colored)	37	6
Active Rate (White)	1.74%	1.67%
Active Rate (Colored)	3.05%	1.74%
Total Rate	3.67%	2.1 %

In a comparison of the above two year periods, it is noted that there is little difference in the total number x-rayed, the number of whites, and the number of colored. There was a definite drop in the number of active cases of tuberculosis in both white and colored, and a marked drop in the number of inactive cases of tuberculosis in both races. The active cases in the white population dropped from 1.74 per cent to 1.67 per cent and in the colored population from 3.05 per cent to 1.74 per cent. The total rate dropped from 3.67 per cent to 2.1 per cent.

For diagnostic confirmation of the above tabulated cases, it is well to state that all admissions to this institution received a patch tuberculin test and that all cases in which a diagnosis of tuberculosis is considered, have sputum examinations made. These patch tests were not repeated nor checked by any other skin testing method. Facilities were not available for cultures and guinea pig inoculations and gastric washings were not done. Only the routine sputum examination was done.

In the far advanced active cases of tuberculosis, 100 per cent had positive sputum and 100 per cent were non-reactors to the tuberculin patch test. Forty per cent of the moderately advanced active cases had positive sputum and 60 per cent reactors to tuberculin. None of the presumptive minimal active cases had positive sputum and 60 per cent reacted to tuberculin. No guinea pig inoculations, cultures, or gastric washings were done on the cases of primary tuberculosis or pleurisy with effusion.

There has been a satisfactory response to the tuberculosis control program that has been in effect here the past four years, the most marked results having been obtained in the colored race and satisfactory results in the white race. Although definite and satisfactory results have been obtained in the practice of this control program and in reducing the cases of tuberculosis from 3.6 per cent to 2.1 per cent, further improvement should and could be made. There has been a definite reduction in the number of cases of extrapulmonary tuberculosis, in the cases of primary tuberculosis, and in the cases of pleurisy with effusion. This probably means the contact rate has dropped.

In the first two years from 1944-45, the cases of tuberculous tracheo-bronchial glands were classified with the cases of pulmonary tuberculosis. In the present study, they were classified as primary tuberculosis and their pulmonary manifestations as extensions of the primary infection. There has been a definite reduction in the number of cases of tuberculosis of the tracheo-bronchial lymph glands in the last two years.

The most marked reduction in the number of cases of tuberculosis in both white and colored, was in the cases of inactive

tuberculosis. We can offer no satisfactory explanation why there is so much greater reduction in the number of such cases unless it is due to the short period of two years which this study covers.

Recommended Control Measures

It was recommended in the previous report that a penal sanatorium be built in Ohio sufficient in size to meet the needs of the State and that an active case-finding program be developed in all the penal institutions and the active cases of tuberculosis be transferred to that institution. This same program adapted to the needs of the individual States and modified to fit into existing facilities is recommended for adoption.

This survey of penal institutions in the United States and Canada, which at best can only be superficial, suggests that probably only the larger and most populous States could practically have a penal tuberculosis hospital. Some of the smaller States may have a large special tuberculosis ward in a penal hospital near a metropolitan area where the services of specialists and rehabilitation facilities may be had. Some States may develop special facilities in one of the State Sanatoria. A few institutions in the sparsely populated Northwestern States and in Maine stated they had not had a case of tuberculosis. These States probably could adequately take care of their patients in a State or County institution where a few special rooms are developed for penal patients. The Federal institutions apparently have facilities for isolating their tuberculous patients in the Medical Center for Federal Penal Institutions at Springfield, Missouri.

Until such time when adequate hospital facilities may be had, the incidence of tuberculosis in penal institutions may be reduced by a tuberculosis control program as outlined here. It is a plan that could be followed in any institution that could have the occasional services of a chest specialist. This program would require little extra help or cost.

It is recommended that all penal institutions initiate a tuberculosis control program with the facilities at hand. All admissions to penal institutions should have chest x-rays together with the other admission examinations. The initial x-ray would preferably be by the large film technique. Inmates who present themselves to the clinic or physician for illnesses in which the diagnosis is not obvious, should be screened for tuberculosis. Suspects should be kept under observation. The institutional staff should have chest x-rays upon hiring, and subsequently at intervals best determined by future experience. Active cases of tuberculosis should be placed in bed in a special section of the penal hospital with the open cases together and the negative sputum cases in a sepa-

rate ward. The different types of collapse therapy should be used as indicated. When the cases progress in their cure to the point when they may be given privileges of mild forms of exercise, they should continue under hospital supervision. After discharge from the hospital, they should be called in at six week intervals for weighing, recording of temperature and pulse and examination. If there is any evidence of reactivation, the patient should be placed in bed again.

After the above control program has been established, survey of the institution by the small film technique may be begun. This may find those occasional cases that are missed by the above method. In this institution, there has been one mass x-ray survey* since the above control program was initiated. Not a single new case was found. Survey by the small film technique may be made at 6 to 12 month intervals or as may be indicated by future experience.

The above may be carried out in any institution and the tuberculosis rate definitely reduced. Also, each State should plan a tuberculosis hospital program for the penal tuberculous. Only in the larger States would it be practical to have a penal tuberculosis hospital. In other States, a special section in a State, County, or Municipal Sanatorium may be prepared for penal patients. In other States where there is a large penal hospital, a special section of this may be suitably used for isolation of the tuberculous.

When the time comes that an adequate number of beds are available for the penal tuberculous, this should not alter the case-finding program. This should continue as before. The tuberculosis hospitals would only take the tuberculous out of the prison population.

It is planned that BCG vaccine be given a trial as a control method here. If successful, it should be a valuable adjunct to the procedures already used.

It is also planned that the routine use of intradermal tuberculin and histoplasmin skin tests be added to the tuberculosis control program here as a matter of correlating the incidence of calcification with tuberculin and histoplasmin reactions.

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*A second mass x-ray survey with the 70 mm. film May 23 to 27, 1949 did not disclose any new cases of tuberculosis.

CONCLUSIONS

1) An active tuberculosis control program has been followed in this institution for four years with reduction in the incidence of tuberculosis from 3.67 per cent to 2.1 per cent.

2) The tuberculosis control program in 78 penal institutions in

the United States and Canada is inadequate in almost all institutions answering the questionnaire.

3) All institutions could markedly decrease the incidence of tuberculosis by actively engaging in a tuberculosis control program with the facilities available.

4) The basis of any control program is built around a place for isolation and treatment. In large populous States, this may be a penal tuberculosis hospital. In smaller States, it may be a penal section in a State or County tuberculosis hospital. In other States, it may be a tuberculosis division of a large penal hospital.

CONCLUSIONES

1) La aplicación de un plan activo para el control de la tuberculosis en esta institución por cuatro años, con reducción en la incidencia de tuberculosis de 6.6 a 2.1 por ciento es presentada.

2) El programa de control de la tuberculosis en 72 instituciones penales en los Estados Unidos y Canadá, es inadecuada, en casi todas las instituciones que contestaron el cuestionario.

3) Todas las instituciones podrían hacer descender la incidencia de la tuberculosis francamente, estableciendo un programa de control con las facilidades que tienen a su alcance.

4) Las bases de cualquier plan de control deben construírse alrededor de la existencia del lugar de aislamiento y tratamiento. En los grandes estados muy poblados, puede haber una institución penal o un hospital penal para tuberculosis. En estados más pequeños, podría ser una sección penal en un hospital de tuberculosos del estado o condado. En otros estados puede haber una división de tuberculosis en un gran hospital penal.

REFERENCE

1 Horst, J. V. and Beatty, O. A.: "A Suggested Tuberculosis Control Program for the Penal Institutions of Ohio," *Ohio State M. J.*, 43:825, 1947.

Tuberculosis Among Indians of the United States

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The most outstanding health problem among the Indians of the United States today is the exceptionally high incidence of tuberculosis. Such a situation creates a serious threat to the acculturation and economic development of the Indian race and constitutes an important reservoir of infection for the non-Indian population of the country. While significant strides have been made to control tuberculosis among Indians, chiefly through efforts of the United States Bureau of Indian Affairs, the accomplishments to date have been far from satisfactory. Tuberculosis among Indians is just as amenable to proper measures of prevention and cure as it is among the white population. The conscientious application of effective control methods will not only aid materially the advancement of the Indian people, but also result in greater progress in tuberculosis control among the general population.

Extent of the Problem

The popular belief that Indians at the time of the discovery of America had a remarkable vitality and freedom from disease is confirmed by the writings of early explorers, colonists, doctors, and missionaries. There is no evidence to show that tuberculosis existed prior to that time. Hrdlicka[1] declares: "As yet no bones of undoubtedly pre-Columbian origin have been found that show tuberculous lesions, and such lesions are very rare in Indian bones dating from the period of the earliest contact with the whites." Scrofula and consumption were observed among the Indians of the Northwest as early as 1633 by Jesuit priests. Evidence from the literature indicates that in the early days of colonization the prevalence of tuberculosis among the Indians was no greater than among the whites, and perhaps not as great.[2] Following closer contact with whites, with restrictions to army posts and reservations, the Indians began to develop and spread the disease with appalling rapidity. Early reports do not give any accurate or reliable information regarding mortality and morbidity rates, but more complete observations have dated from the establishment of the Indian Medical Service as part of the Bureau of Indian

Affairs in 1873. The records indicate that tuberculosis continued to steadily increase until the latter part of the nineteenth century reaching an average morbidity rate of 23 per cent in 1884.[3] Hrdlicka[4] investigated in 1908 the morbidity of tuberculosis among a group of 107,000 Indians. He recorded 2,836 instances of the disease which were divided as follows: 1,038 pulmonary tuberculosis, 208 tuberculosis of the bones and joints, and 1,590 tuberculosis of the lymph nodes. It was found that the tribes which had the longest contact with the whites were the most seriously affected. The morbidity rate far exceeded that noted among the white population of that period.

In 1912 the United States Public Health Service made a comprehensive survey of infectious diseases among the Indians.[5] During the survey, 39,231 individuals, or approximately one-eighth of the Indian population, were examined. The tuberculosis morbidity rate for this group was 3.5 per cent, and considerable variation was found among the different tribes. The incidence was lowest among the New York tribes with a rate of only 1.3 per cent and reached as high as 32.7 per cent among the Paiutes of Nevada. The mortality from tuberculosis for the entire group was 506 per 100,000 population. It is interesting to note that during the same year the Bureau of Indian Affairs reported a total of

TABLE 1

YEAR	Tuberculosis Deaths per 100,000 Indian Population (compiled by Bureau of Indian Affairs)	Tuberculosis Deaths Per 100,000 General Population (U. S. Census Vital Statistics)
1912	1,040	145.4
1913	971	143.5
1914	919	141.7
1916	640	138.4
1918	630	149.8
1920	608	113.1
1923	439	91.7
1930	354.6	71.1
1939	265.1	47.1
1940	264.3	45.8
1941	275.8	44.5
1942	259.2	43.1
1943	206.2	42.6
1944	268.2	41.3
1945	211.9	40.1

7,886 cases of tuberculosis from a group of 58,266 Indians examined, an incidence of 13.5 per cent; and a death rate of 1,040 per 100,000.[6] Such paradoxical results denote inadequate and inaccurate means of study and reporting due in part to the limitations of examinations. Although the above findings cannot be accepted as conclusive, sufficient evidence was accumulated during the Public Health survey to convince the investigators that tuberculosis was much more widespread than among the white population.

Since 1912 there has occurred a definite trend towards lower mortality and morbidity rates. The decline in mortality from tuberculosis is indicated in Table 1, which compares the rates among the general population of the United States with the Indian population.

The Bureau of Indian Affairs established in 1929 a system for the routine collection of reports of mortality rates, and data subsequent to that time are much more reliable. Encouraging as these statistics are in depicting a great reduction in deaths from tuberculosis, they also show rates of approximately five times that noted among the general population.

While these figures on mortality rates are a crude measure of the overall incidence of the disease, a more complete picture is obtained from morbidity rates as determined by clinical and x-ray surveys. In a ten-year series of clinical examinations by the Bureau of Indian Affairs, the rate decreased from 16.2 per cent in 1911 to 12.1 per cent in 1920.[7] The average number of annual examinations was 64,543, or about one-sixth of the population. In surveys made from 1927 to 1933, the percentage of Indians examined which were found to have tuberculosis varied from 25 per cent of the Chippewas in Minnesota to 2 per cent of the Santees in Nebraska, with an average incidence of 10.1 per cent.[8]

Aronson,[9] working with the Office of Indian Affairs, initiated in 1935 a program for the study of tuberculosis among Indians. The extent of tuberculous infection and disease was determined in certain areas where BCG vaccine was later to be evaluated in the control of tuberculosis. Aronson and his group tuberculin-tested 8,420 Indians of the Pima, Shoshone, Arapahoe, Sioux, and Alaskan tribes from 1935 to 1937. The incidence of positive reactors was over 50 per cent at 10 years of age and rose rapidly with increasing age, reaching approximately 100 per cent of individuals 25 years of age or above. It was shown that the percentage of positive reactors among Indians exceeded that previously noted by him among the negroes in rural areas of some of the southern states and among the whites in rural areas of Michigan. Roentgenological examinations of the chest were made during 1936 and 1937 of 16,046 Indians, who composed a significant sample of the

general population in each tribe. The incidence of pulmonary tuberculous lesions of clinical significance was lowest among the Pima Indians with 1.1 per cent and highest among the Alaskan Indians with 6.9 per cent, with an overall average of 5.2 per cent.

Lower incidences in recent years are reported by Dahlstrom,[10] who is conducting a series of mass x-ray surveys among Indians of the United States. He summarizes his findings (Table 2) on the occurrence of significant pulmonary lesions characteristic of tuberculosis as based on roentgenological examinations. In comparing these results with those obtained among mass surveys of the general population, it is evident that the incidence of tuberculosis, as observed by roentgenological examinations of the chest, is significantly higher among the Indians than that found among the general population.[11]

Causes of the Problem

Because tuberculosis is so widespread among the Indians, it has been assumed, by many, that they have a racial susceptibility to the disease and develop the more acute, progressive types of tuberculosis. Most authorities who have observed and studied the disease among Indians, however, agree that Indians as a race are not peculiarly susceptible to tuberculosis and develop the same type of disease, in the same manner, as that observed among the white population. Alley,[12] after reviewing chest roentgenograms of Oklahoma Indians, noted that "completely healed lesions are often

TABLE 2

Year of Survey	Reservation Surveyed	Number X-Rayed	Significant Lesions	Per cent Incidence
1940	Apache, Arizona	3,484	71	2.0
1945	Crow Creek, South Dakota	513	13	2.4
1945	Tomah, Wisconsin (County Survey)	89	2	2.2
1945	Zuni, New Mexico	827	26	3.1
1945	Wind River, Wyoming	610	25	4.1
1946	Winnebago, Nebraska	1,684	18	1.1
1946	Sisseton, South Dakota	1,029	13	1.3
1946	Red Lake, Minnesota (State Dep't. Health Survey)	1,643	67	4.1
1947	Pine Ridge, South Dakota	2,880	92	3.2
1947	Rosebud, South Dakota	2,659	54	2.1
1948	Navajo, Arizona (as of Oct.)	14,069	647	4.6
	TOTAL SURVEYED	29,487	1,028	3.2

noted and lesions in which the healing process is taking place are more frequently noted." Among these cases of presumable tuberculosis, the majority received no treatment and had no history of symptoms, indicating that natural healing takes place in Indians as well as whites. Alley has observed exceptionally few rapidly advancing lesions among sanatorium patients and finds that Indians respond very well to treatment. Aronson[13] states that fibrosis and calcification are common and that the disease in many instances runs a long chronic course, even in the moderately or far advanced cases. He is also of the opinion that tuberculosis among Indians has undergone a change in character, and that there is much less of the extrapulmonary forms previously seen. As noted above, Hrdlicka[14] found in 1908 that over 63 per cent of tuberculosis was extrapulmonary in nature. Indian Medical Service physicians have observed fewer instances of extra-pulmonary forms of tuberculosis than formerly. These workers find no significant difference between the course or character of tuberculosis in Indians as compared to whites. Apparently the same defense mechanism operates in both Indians and whites, and immunological or racial factors play only a minor, if any, role in the cause of the high prevalence of tuberculosis among Indians.

The underlying economic and sociological conditions are perhaps more important. An evaluation of these conditions cannot be attempted without some understanding of the Indian people and the changes in environment which they have undergone. The advent of the whites created a struggle for existence that was fertile soil for the seeding and dissemination of tuberculosis. With the exception of some southwest Indians, the more than 200 tribes lived a nomadic existence in pre-Columbian times. The subsequent exploitation of the country determined their confinement to areas set aside as reservations under Federal control. In these restricted areas, they found it difficult to adjust to sedentary living and to a change in cultural pattern. Their roving life of former days dictated temporary shelter only large enough to protect the family unit against the elements. Adequate dwelling space, sanitary ways of living under crowded conditions for indefinite periods, and balanced diets were not effective parts of the economy pattern. The nomadic way of life in a bountiful land provided for them naturally. So when doomed to reservation life without sufficient experience of living under these conditions, they merely did the only thing they knew how to do—erect a place to live just large enough to protect them against the elements, dispose of their refuse without regard to its effect on the health of the family and community, and eat whatever was at hand without concern for any special preparation that might

preserve its nutritional value. This gap is only a part of the total cultural lag and economic maladjustment which left them prey, as it will any group of people similarily afflicted socially and economically, to the ravages of tuberculosis. Such adverse conditions were conducive to massive and continuous exposure to the disease and resulted in universal infection approaching epidemic proportions.

The Federal Government in virtual control since 1824 has done little to bring the Indians to a level in living conditions comparable to that of the general population. Its appropriations to the Bureau of Indian Affairs have always been niggardly. The main resource of the Indians was, and still is, land which has been so reduced in acreage that there does not now remain enough to support them at an income level sufficient to provide proper home life and living conditions. Not endowed by training or habit pattern as exploiters of the land in the modern sense, coupled with inadequate credit and meager assistance in land use education, they continue to exist in rural slums. In addition, they are beset by overpopulation in the areas left to them. The efforts of the Bureau of Indian Affairs, with its curtailed budget, are not able to keep pace with the need for both youth and adult education and rehabilitation to raise the standard of living to maintain normal health. The resultant poverty has an important, and direct, influence on the health of the Indian population by allowing inadequate housing space, insanitation, and malnutrition to exist.

Murphy's[15] statement that "The spread of the disease is primarily fostered by conditions existing in the homes. . . ." is unfortunately quite correct; for such conditions do have close correlation with the amount of tuberculosis among Indians. The average dwelling is built of clay, reeds, stones, or logs found in the immediate vicinity. The floors are usually made of dirt and proper ventilation is lacking. Frequently extremely ill patients are found living in a small one-room cabin with no, or very little, window space. Overcrowding is the rule with two or more generations living in close proximity in the same household. Young children subjected to such an environment cannot avoid infection with tuberculosis. Drinking water is obtained from wells, springs, streams, or irrigation ditches; and often is contaminated from domestic sewage. In many instances, the water must be transported from great distances and the supply may be limited, making difficult personal and household cleanliness even if the Indians were so inclined.

The influence of living conditions on the incidence of infection is well demonstrated by Aronson.[16] He found in 1936, on the Rosebud Reservation in South Dakota, that 79 per cent of the children

attending the government and mission boarding schools had positive tuberculin reactions, whereas only 32 per cent of the Indian children attending the public schools so reacted. The Indian children in the public schools came from homes comparable to those of the neighboring white population, while the boarding school children came from the more crowded, poorly housed families living under conditions similar to those in urban slums of the larger cities. In addition one must consider such factors as overcrowding and inadequate facilities in Indian boarding schools, where the children live in close association all during the school year, which may lend themselves to easier spread of infection. Ferguson[17] further illustrates the relationship of living conditions to tuberculosis by showing a decreased death rate among the Indians of the File Hills Demonstration Colony in Saskatchewan, Canada comparable to that of the surrounding white population. These Indians lived under conditions similar in every way to those of the whites. However, those living under conditions typical of reservation standards did not have such a decrease.

The diet of the average Indian is not balanced and is deficient in many respects. Milk and fresh vegetables are seldom used, and most meals are poorly prepared. In general fats and carbohydrates are proportionately in excess, although certain groups subsist on meat almost exclusively. The Bureau of Indian Affairs has in the past issued rations of bare necessities, but now provides only the needy ones with funds to purchase food as they desire. Unfortunately, the food is improper from the standpoint of quality, quantity, and variety; and malnourishment and a debilitating state of health often result, making the Indians predisposed to the development of all diseases, including tuberculosis.

Lack of sanitary facilities on the reservation and in the homes is usually encountered. In addition, there is frequent disregard for the most elementary principles of personal hygiene and sanitation. Imbued with the primitive conceptions of the medicine man, the Indians have not readily accepted the idea that tuberculosis, and other diseases, are caused by invisible germs and that these germs may be present in healthy appearing individuals. They have not had sufficient exposure to health education to enable them to understand fully the factors involved in health and disease. Language difficulties and an inherent native reticence make them somewhat apprehensive of non-Indian health workers when health education programs are carried out.

Many social habits and tribal customs, which are a vital component of the structure of reservation life, contribute much to the spread of tuberculosis. The sick are visited freely without

regard to the condition of the patient. Indians frequently gather together for ceremonials and feasts where the ordinary facilities for proper sanitation are absent. At such times there is little concern for sanitary measures, and both sick and well intermingle freely. Individuals with active tuberculosis present in these groups transmit their infection readily into healthy families.

Inadequate medical care in many areas results in ineffective control over tuberculosis. Insufficient number of sanatorium and hospital beds prevent the isolation of all active cases, endangering the health of others in the community. The Federal Government, hasty to help downtrodden people of foreign lands, allows only a meager appropriation to the Bureau of Indian Affairs for medical services. In many cases, it has been impossible to detect tuberculosis until it has totally incapacitated the individual, and he comes to the attention of the medical profession too late for any beneficial therapy. Because medical care is not freely accessible to many Indians on various reservations, they hesitate to consult physicians until dire emergencies arise, making control of tuberculosis difficult and unsatisfactory.

Control of the Problem

In determining the causes of the high incidence of tuberculosis among Indians, no single factor can be isolated. They are all interwoven with, and dependent upon, one another. Consequently, our approach to the control of the problem involves the integration of many activities. Much has been contributed toward the control of tuberculosis among Indians not only by the Bureau of Indian Affairs, but also by the United States Public Health Service, National Tuberculosis Association, and various private organizations. The Bureau of Indian Affairs is attempting to meet the problem as part of a general health program instituted in the early part of 1947.[18] As evidence of its activity, mobile photofluorographic units are now in operation conducting mass surveys on various reservations, and BCG vaccination has been introduced in certain areas. Fundamental control measures which have been so effective among whites are being applied in many instances. The spirit which animates this work is worthy of commendation and encouragement; however, the program now inaugurated is limited by lack of sufficient funds and needs further impetus to achieve ultimate control of tuberculosis.

First of all, there is urgent necessity for the immediate improvement of the economic status of the Indian before we can secure any definite and lasting results in controlling tuberculosis. Any improvement in health will be greatly accelerated by enabling the Indians to earn a decent livelihood and thereby achieve a

better standard of living. The policy of the Bureau of Indian Affairs during the past 15 years has been to establish a self-supporting economy among the Indians. They have been encouraged to accept more responsibility over their own affairs. Eventually it is expected that the Indians will assimilate into the general population and take their place in the national framework. But it is obvious that they must first be brought up to the standards of the general population, economically and otherwise. The majority of Indians derive their income from agricultural pursuits, including livestock raising, but there is not sufficient productive land to provide even a mere subsistence economy. It is necessary that the Indians be encouraged to protect and develop their resources, especially lands, and adding to them wherever possible. With overpopulation accentuating the problem, the land must be used to the fullest productive capacity; and, at the same time, the excess population dispersed into industry. On the reservations where feasible, the Indians should be encouraged to engage in craft industries which have a definite functional value in American life. The American public should aid Indians to adjust to off-reservation employment when such opportunity exists. Fortunately, Indians may obtain loans from a revolving fund set up by the Bureau of Indian Affairs for use by the individual or by the tribe or corporation, and this has met with considerable success. A further discussion of the problem of economic rehabilitation is beyond the scope of this paper; however, the need for its solution cannot be overemphasized. Until this is done, tuberculosis control programs will help, but the control will not be general as the poverty of the Indian people will keep fertile the media from which the disease keeps coming to the surface.

Sanitation has perhaps been the most neglected phase of the general health program in the past. It is recognized, of course, that any great amount of structural changes in health conditions must await improvement in the financial status of the Indians. Nevertheless, much might be accomplished by an intensive program of health education and directing attention towards methods of prevention. As with other economically depressed groups, the Indians must be taught how to live properly, how to prepare food to obtain the utmost nutritional value, and most important of all, how to combat the spread of disease. It is necessary that the instruction be presented in a manner understandable to them, whether it be by lectures, films, bulletins, or demonstrations. The Indian community offers in many respects an ideal setting for cooperative enterprises by health workers with other groups for the betterment of health: with agricultural agents for the promotion of proper food and livestock raising; with home demon-

stration agents for the improvement of home conditions; with social welfare workers for aid to the more destitute families; with educators for health instruction of school children; and with the Tribal Council itself to bring the Indians into the scheme of organization for health. Murphy[19] is of the opinion that, "The Indian children will be the best promoters of new ideas in the home, and will be able through the training received at school to advance materially all efforts along health lines. The education of younger Indians will be the quickest and most effective means of disseminating knowledge as to the nature of tuberculosis, and best means of prevention and cure." In recent years, the returned war veterans and war workers have added some contribution toward informing the family group about proper health measures. Every avenue of educational approach must be tapped in order to establish in the Indians a community concept of the disease. For, only when they develop an interest in the tuberculosis problem and understand its importance, will the Indians cooperate fully in its control.

The most immediate phase of the control program is the use of comprehensive case finding surveys to locate the sources of tuberculosis on the reservation and the provision of their hospitalization. At the present time, the Bureau of Indian Affairs is employing the photofluorographic portable x-ray unit on some reservations. Such efforts should be given encouragement and financial support so that a significant proportion of the Indian population can be reached in a relatively short time. Because the Indian groups are so small and well localized on reservations, large numbers of the people are easily accessible for examination. In these ideal survey centers, concerted programs can be carried out on an extensive scale rapidly and at little cost. By this means, Indians who show indications of tuberculosis on roentgenograms can be studied further to determine the diagnosis; and if found to have active disease, they can be segregated immediately so as to remove the sources of infection from the rest of the population. It is obvious that the value of the case finding surveys depends on the completeness and adequacy of the follow-up study. Well equipped clinical and laboratory facilities are necessary for accurate diagnosis. Careful examination of all contacts is an important part of the control program.

Although the status of BCG vaccination has not been definitely established in control programs of the past,, increasing evidence of its value among Indians has been shown. Aronson[20] investigated the use of BCG among a group of Indians of the United States and Alaska since 1935. It was administered to 1,551 Indians ranging in age from less than one year to 20 years, and at the same time

1,457 Indians of comparable age and living under the same conditions served as controls. They were followed over a period of nine to eleven years, and 6 deaths from tuberculosis occurred among the vaccinated group while 53 deaths from tuberculosis occurred among the controls. The mortality rate per 1,000 person-years of observation was 0.4, and 3.5 for the vaccinated and controls, respectively. Also a group of 123 newborn infants was vaccinated and 139 newborn infants served as controls. The infants were observed over a period of six to eight years; and no deaths have occurred from tuberculosis among the vaccinated, while among the controls 4 have died from tuberculosis. Aronson further found that roentgenologically demonstrable lesions having the characteristics of primary tuberculosis occurred in 22 of the vaccinated and in 120 of the controls. Minimal lesions of reinfection type, progressive lesions and miliary and extrapulmonary lesions of tuberculosis were found in 21 of the vaccinated and 93 of the controls. These results indicate that BCG-vaccinated Indians do have lowered mortality and morbidity over a fairly long period of observation. Because this evaluation has demonstrated that BCG may be used effectively as an immunizing agent, the control program should embody a vaccination plan whereby tuberculin negative individuals will receive BCG vaccine. The Bureau of Indian Affairs began the vaccination of 600 Indians in Alaska in the summer of 1948. Widescale vaccination of tuberculin negative children in the Indian boarding schools is now being initiated among Indians of the southwest and Dakotas. It is planned to expand this program, if funds are available, to include all tuberculin negative individuals.

The control of tuberculosis does not stop when the case finding survey and BCG vaccination is completed. There must be repeated examinations at frequent intervals to discover new sources of infection. Roentgenograms of the chest should be made of all individuals reaching adulthood and yearly thereafter, if at all possible.

Finally, there should be provision for adequate medical and sanatorium care for all active cases discovered. From a public health point of view, isolation is necessary if the spread of disease is to be prevented. In addition, proper treatment may arrest the disease if it is not too advanced and restore the individual as a functioning member of society. The Indian Medical Service now has 1,012 beds in hospitals and sanatoriums for tuberculosis patients. In addition, there are about 300 beds under contract in county and state hospitals. In view of the mortality and morbidity data previously presented, it is obvious that, with an Indian population of over 400,000, many more beds are needed. The

Federal Government should be urged to augment the program of tuberculosis control by appropriating sufficient funds for the adequate provision and maintenance of hospitals and medical care. The time and money spent in discovering active cases will largely go to waste if beds are not available for treatment of those with remediable disease and for isolation of the infectious patients. It is short-sighted to concentrate on case finding, if treatment is to be delayed because of a shortage of beds. Even if beds are not immediately available, attempts should be made to isolate and treat patients in the home or establish separate dwellings in the villages until such time as hospital facilities can be obtained.

The heavy toll of the Indian population taken by tuberculosis for years can be reduced and eventually controlled if our knowledge of its epidemiology and treatment is put into practice. Because the Indians constitute such a small population of the United States and are so easily reached, and because they respond so well to treatment, there is no reason why the ultimate control of tuberculosis is not feasible. The recent development of streptomycin and the use of BCG vaccine have added much to our armementarium against the tubercle bacillus. However, this does not mean that we relax our efforts and need not deter us from making immediate and conscientious use of the fundamental control measures now available.

SUMMARY

1) The high incidence of tuberculosis is the most outstanding disease problem among the Indians of the United States. There is no evidence that tuberculosis existed among them in pre-Columbian times. The prevalence of the disease, as indicated by mortality and morbidity rates, and by x-ray surveys, has shown a gradual decrease throughout the years; however, recent mortality figures are over five times that of the general population, and x-ray surveys have shown an incidence of over 3 per cent pulmonary lesions characteristic of tuberculosis.

2) The course and character of tuberculosis among the Indians does not differ significantly from that among the whites. Indians appear to exhibit no peculiar racial susceptibility to tuberculosis, and immunological factors have little influence in the high prevalence of the disease among them.

3) Environmental changes coincident with the advent of the whites, and subsequent socio-economic conditions on the reservations, have been largely responsible for the high rate of tuberculosis among the Indians. Inadequate medical care and facilities, dependent upon funds from the Federal Government, have also played an important part.

CONCLUSION

Although significant strides have been made to control tuberculosis among Indians, the accomplishments to date have not been satisfactory. There must be improvement in the economic status, sanitation, and medical facilities before any real results can be realized. Active case finding surveys are to be encouraged, and provisions made for adequate isolation and treatment of those found to have active disease. It has been shown that BCG vaccine has decreased mortality and morbidity rates, and has a place in the control program. This does not obviate the need, however, for the conscientious application of the fundamental control measures now available, which have proven so successful among the white population. For it is evident that tuberculosis among Indians is just as amenable to the proper methods of control as it is among the whites.

RESUMEN

1) El más destacado problema sanitario entre los indios de los Estados Unidos es la frecuencia de la tuberculosis. No hay pruebas de que esa enfermedad existiera antes de la llegada de Colón. La frecuencia de la enfermedad según la señalan los índices de morbilidad y de mortalidad así como el catastro radiológico, ha mostrado tendencia a decrecer a través de los años; sin embargo, las cifras recientes aún son más de cinco veces mayores que las de la población general y la investigación en masa por los rayos X ha demostrado una incidencia de más de 3 por ciento de lesiones pulmonares características de tuberculosis.

2) La evolución y el carácter de la tuberculosis entre los indios de Norteamérica, no difiere significativamente de lo que se observa en los blancos. Los indios no ostentan susceptibilidad racial alguna peculiar ante la tuberculosis y los factores inmunobiológicos tienen pequeña influencia en la alta frecuencia de la enfermedad entre ellos.

3) Los cambios ambientales coincidentes con la llegada de los blancos y las subsecuentes condiciones socio-económicas de las reservaciones, son en gran parte los causantes del alto índice tuberculoso entre los indios. La atención médica inadecuada y comodidades que dependen de el uso de fondos del Gobierno Federal, también han desempeñado un papel importante en esto.

CONCLUSION

Aunque se han dado pasos significativos en el control de la tuberculosis entre los indios de Norteamérica, lo obtenido hasta ahora no es satisfactorio. Debe haber mejoría de la situación

económica, de la sanidad, y de las facilidades de atención médica antes de que puedan observarse resultados tangibles. Hay que estimular la búsqueda de los casos de enfermedad activa, proveer a su aislamiento, así como a su tratamiento. Se ha demostrado que el uso de la vacuna BCG ha hecho decrecer la morbilidad y la mortalidad y que tiene este medio un lugar en el proyecto de dominio de la enfermedad. Esto no descarta la necesidad de aplicar conscientemente las medidas fundamentales de control ahora asequibles que han demostrado su eficacia entre la población blanca. Porque es evidente que la tuberculosis entre los indios es susceptible de responder a los métodos de eradicación como lo es entre los blancos.

REFERENCES

1 Hrdlicka, A.: "Tuberculosis Among Certain Tribes of the United States," Bulletin 42, *Bureau of American Ethn.*, Gov. Ptg. Office, Washington, D. C., 1909.
2 "Tuberculosis Among North American Indians," *Report of a Committee of the Nat. Tuberc. Assoc.*, 63rd Cong., 4th Sess., Gov. Ptg. Office, Washington, D. C., 1923.
3 Ibid.
4 Hrdlicka, A.: Op. Cit.
5 "Contagious and Infectious Diseases Among the Indians," *S. Doc. No. 1038*, 62nd Cong., 3rd Sess., Gov. Ptg. Office, Washington, D. C., 1913.
6 "Tuberculosis Among North American Indians," Op. Cit.
7 Ibid.
8 Mountin, J. and Townsend, J.: "Observations on Indian Health Problems and Facilities," *Pub. Health Bull. No. 223*, Gov. Ptg. Office, Washington, D. C., Feb., 1936.
9 Aronson, J., Townsend, J., Saylor, R. and Parr, E.: "Tuberculosis Control Among the North American Indians," *Am. Rev. Tuberc.*, 15:41, 1942.
10 Dahlstrom, A.: Unpublished reports from the files of the Medical Service of the Bureau of Indian Affairs, Jan., 1949.
11 Hilleboe, H. and Morgan, R.: "Mass Radiography of the Chest," *The Year Book Publishers, Inc.*, Chicago, Ill., 1945.
12 Alley, R.: "Tuberculosis Among Indians," *Dis of Chest*, 6:44, 1940.
13 Aronson, J.: "Protective Vaccination Against Tuberculosis With Special Reference to BCG Vaccination," *Am. Rev. Tuberc.*, 58:255, 1938.
14 Hrdlicka, A.: "Tuberculosis Among Certain Tribes of the United States," Op. Cit.
15 Murphy, J.: "The Work of the U. S. Indian Medical Service," *Survey*, 33:444, 1915.
16 Aronson, J., Townsend, J., Saylor, R. and Parr, E.: Op. Cit.
17 Ferguson, R.: "Tuberculosis Among the Indians of the Great Canadian Plains," Trans. of the Fourteenth Annual Conference of the National Tuberculosis Association for the Prevention of Tuberculosis, *Adlard and Son*, London, 198.
18 DeLien, H. and Dahlstrom, A.: "Tuberculosis Control Handbook," United States Ind. Service, *Haskell Inst. Ptg. Dep't.*, Lawrence, Kansas, Jan., 1947.
19 Murphy, J.: "The Prevention of Tuberculosis in Indian Schools," *Nat. Ed. of U. S. Jour. of Proc. and Addresses*, Gov. Ptg. Office, Washington, D. C., 1909.
20 Aronson, J.: Op. Cit.

Editorial

TUBERCULOSIS AMONG AMERICAN INDIANS

There has long been extant the idea that American Indians are exceedingly susceptible to tuberculosis, that they have little or no resistance, and therefore there is not much to be done for them. To state such an opinion apparently is to hark back to reports of tuberculosis sweeping rapidly through tribes, causing great destruction. Some of these observations were made before the tubercle bacillus was discovered, before the tuberculin test was available and postmortem examinations were infrequent. Our present day diagnostic criteria would not permit such reports. Therefore, one may seriously question whether some of the rapidly progressive and highly fatal conditions attributed to tuberculosis were caused by the tubercle bacillus. Certainly the evidence is not sufficient to escape honest questioning.

With additions to diagnostic armamentarium, only two of which are specific for tuberculosis, namely, the recovery of tubercle bacilli and the tuberculin reaction, accurate diagnosis has been possible. On many reservations the disease is prevalent. High mortality, morbidity and infection attack rates obtain, but nothing about them is peculiar to the Indians. For every reservation where a serious tuberculosis situation exists there is an identical problem among populations of similar size living under like conditions among people of the Caucasian and Yellow races.

It is difficult to fathom the logic which leads one to state that a serious tuberculosis situation among Indians is due to the relatively recent introduction of the tubercle bacillus, high susceptibility, lack of immunity, etc., when identical conditions obtain in large populations of Caucasian and Yellow races, among whom the tubercle bacillus was introduced thousands of years ago and therefore should have high immunity or resistance to the organism.

In this issue of *Diseases of the Chest,* Albert Reifel, an Indian himself, reared on a reservation where tuberculosis is rife, a student of all aspects of Indian life and the diseases which attack his race, and especially informed on all phases of tuberculosis, with personal experience with the disease in its clinical forms, presents up-to-date information concerning tuberculosis among Indians. He includes well documented evidence that the Indian is not more susceptible to tuberculosis than Caucasians under the same living conditions. The Indian resists the disease by the same defense mechanism as his Caucasian countryman. Moreover, he responds to the same kind of treatment, and the control of

the disease in a given population is accomplishable by the same methods among Indians and Caucasians. Similar findings have also been reported by Burns, one of America's leading students of tuberculosis among Indians.

Why, then, is there still more tuberculosis among Indians on some reservations than in Caucasian populations adjacent to them? The answer in large part is to be found in Dr. Reifel's article. Indians have received little health education, partially because of language difficulties, social habits and customs. During this century we have conducted effective educational campaigns against tuberculosis, but have failed to carry information to the Indians in a way that he understands. We have not provided a sufficient number of sanatorium beds to adequately protect the Indian family and community against contagion. We have not searched for the infected Indian and kept him under close surveillance so as to detect clinical disease as soon as possible, if and when it occurs. Therefore, most Indians who develop progressive tuberculosis have their disease detected only after it has become advanced, and a high percentage of them die, just as surely but no more so than Caucasians under the same circumstances.

There are approximately 400,000 American Indians in the United States. Some of them are now in our large cities, others remain in rural communities, and many still reside on reservations. Attempts made to control their tuberculosis have been far too feeble. Many workers, including physicians, have a fatalistic point of view because they cling to the erroneous belief that the Indian's susceptibility is so high, his resistance so low, his disease so untreatable that the problem cannot be solved. This has led to the unfortunate, "Let's try it on the Indians" attitude with reference to almost any experimental, unproved and unscientific method or substance that may be advocated by the occasional individual. Apparently the control of tuberculosis among the Indians, wherever they are, can be accomplished by the same fundamental methods that have proved so effective among the people of other races.

J. A. M.

JOSEPH C. PLACAK, M.D., F.C.C.P.

PRESIDENT

American College of Chest Physicians

1949-1950

Dr. Joseph C. Placak Installed as College President

Dr. Joseph C. Placak was installed as President of the American College of Chest Physicians at the Fifteenth Annual Meeting of the College held in Atlantic City, June 2-5, 1949.

Dr. Placak was born in Cleveland, Ohio on February 22, 1882. He was educated in the Cleveland Public Schools, Western Reserve University and the University of Prague, Austria. For several years he served as medical director of the municipal sanatorium for tuberculosis in Cleveland and as Head of the Division of Tuberculosis, Cleveland City Hospital, a post which he held until 1942. He also served as Director of the Department of Medicine at St. Johns Hospital. Dr. Placak served in the first World War as a major in the Medical Corps of the United States Army. He was Chief of the Medical Service at the Evacuation Hospital and a member of the Third Army Disability Board, Coblenz, Germany. His principal hospital connections are Consulting Physician, Lake County Memorial Hospital and Consulting Physician, Doctors Hospital. He is President of the Anti-Tuberculosis League of Cleveland and Cuyahoga County.

Dr. Placak is a Fellow of the American College of Chest Physicians, the American College of Physicians, the American Medical Association, and a member of the Board of Internists, the Cleveland Academy of Medicine, the Ohio State Medical Society, the National Tuberculosis Association, the American Trudeau Society, the Public Health Committee of the Cleveland Chamber of Commerce, and the Health Council of Cleveland, Ohio.

Annual Meeting, Board of Regents

The Board of Regents of the College convened at the Ambassador Hotel, Atlantic City, Thursday, June 2 at 2:00 p. m. and again on Sunday, June 5 at 5:00 p. m. Dr. Paul A. Turner, Louisville, Kentucky, Chairman of the Board, presided. The following Regents, alternates and invited guests attended the meeting:

Paul A. Turner, M.D., Louisville, Kentucky, Chairman
Donato G. Alarcon, M.D., Mexico City, Mexico
Robert J. Anderson, M.D., Washington, D. C. (invited guest)
Russell S. Anderson, M.D., Erie, Pennsylvania (invited guest)
Carl C. Aven, M.D., Atlanta, Georgia (Chairman, Board of Governors)
Dean B. Cole, M.D., Richmond, Virginia
Martin H. Collier, M.D., Blackwood, New Jersey
M. Jay Flipse, M.D., Miami, Florida (alternate)
Carl H. Gellenthien, M.D., Valmora, New Mexico
E. E. Glenn, M.D., Springfield, Missouri (alternate)
Edward A. Greco, M.D., Portland, Maine
Edward W. Hayes, M.D., Monrovia, California
Charles M. Hendricks, M.D., El Paso, Texas
Robert B. Homan, Jr., M.D., El Paso, Texas
William A. Hudson, M.D., Detroit, Michigan
Minas Joannides, M.D., Chicago, Illinois
Lopo de Carvalho, M.D., Lisbon, Portugal
Edwin R. Levine, M.D., Chicago, Illinois (invited guest)
S. U. Marietta, M.D., Washington, D. C.
Louis Mark, M.D., Columbus, Ohio
Amadeo Vicente Mastellari, M.D., Panama City, Panama
Gustav Maurer, M.D., Davos, Switzerland
Donald R. McKay, M.D., Buffalo, New York
Fred M. F. Meixner, M.D., Peoria, Illinois (invited guest)
Jay Arthur Myers, M.D., Minneapolis, Minnesota
Antonio Navarrete, M.D., Havana, Cuba
James M. Odell, M.D., The Dalles, Oregon
William E. Ogden, M.D., Toronto, Canada
Richard H. Overholt, M.D., Brookline, Massachusetts
J. Winthrop Peabody, M.D., Washington, D. C.
Walter L. Phillips, M.D., Cape Town, South Africa (invited guest)
Joseph C. Placak, M.D., Cleveland, Ohio
James H. Stygall, M.D., Indianapolis, Indiana
William C. Voorsanger, M.D., San Francisco, Calif. (invited guest)

Murray Kornfeld, Chicago, Illinois, Executive Secretary
Harriet E. Lumm, Chicago, Illinois, Assistant Executive Secretary

After the signing of the College Register, the newly elected Regents, the Regents from other countries, the alternate Regents and invited guests were introduced. Dr. Donato G. Alarcon, Regent for Mexico, reported on the Congress of the Union of Latin American Tuberculosis Societies held in Mexico City last January in which the College participated. Dr. Gustav Maurer, Regent for Central Europe, reported on the progress of the College program in the countries under his jurisdiction.

The Treasurer of the College, Dr. Minas Joannides, then presented his report which was moved for adoption by Dr. Antonio Navarrete, seconded by Dr. Louis Mark, and approved by the Board. The Report of the Treasurer of the College was published in the July issue of the journal.

Dr. Charles M. Hendricks, Chairman of the Committee on College By-Laws, presented the revisions in the By-Laws of the College and entered a motion that the Board approve the revised By-Laws. The motion was seconded by Dr. E. W. Hayes and the revised By-Laws were adopted.

The revised By-Laws were subsequently presented before the administrative session of the College on Saturday, June 4, for the vote of the membership and were approved unanimously.

Dr. E. W. Hayes, Chairman of the Council on Undergraduate Medical Education reported on the success of the book entitled "The Fundamentals of Pulmonary Tuberculosis and Its Complications" which has recently been published under the sponsorship of the College. Dr. Hayes reported that the companion book on nontuberculous diseases of the chest is almost completed and will be published at an early date. Dr. Joseph C. Placak declared that a vote of thanks should be given to Dr. Hayes for his untiring efforts; the motion was seconded by Dr. Donald R. McKay, who stated that the New York Chapter of the College has presented a copy of "The Fundamentals of Pulmonary Tuberculosis and Its Complications" to the library of each of the New York State medical schools. Dr. Hayes' report was unanimously adopted.

Dr. J. Winthrop Peabody, Chairman of the Council on Postgraduate Medical Education, presented his report of the activities of the council during the past year and the plans for the coming year. It was announced that postgraduate courses in diseases of the chest will be given in Chicago, September 19-23, in Minneapolis, October 20-22, in New York City, November 14-18, and in San Francisco, December 5-9, with the cooperation of the College Chapters in the various states and the staffs of the leading medical schools and hospitals. Dr. Peabody's report was accepted with a vote of appreciation for his excellent work.

In the absence of Dr. Andrew L. Banyai, Milwaukee, Wisconsin, Chairman of the Council on European Affairs, the report of this council was presented by Dr. Joseph C. Placak, the Vice-Chairman. Dr. Placak reported that an invitation was received from Dr. A. Omodei Zorini, Director of the Forlanini Institute, Rome, Italy, to hold the First International Congress on Diseases of the Chest in Rome in September of 1950. This Congress to be sponsored by the Council on International Affairs of the College. After complete discussion by the members of the Council on International Affairs it was unanimously voted that proper arrangements be made for this Congress. Those present and voting at the council meeting held on June 5 were:

Professor Lopo de Carvalho
Professor Gustav Maurer
Dr. Richard H. Overholt
Dr. Chevalier L. Jackson
Dr. Jay Arthur Myers
Dr. Italo Volini
Dr. Minas Joannides
Dr. Edgar Mayer
Dr. Joseph C. Placak

The Council on International Affairs presented the following resolution:

THEREFORE, BE IT RESOLVED, That the Board of Regents of the American College of Chest Physicians accept the recommendations of the Council on International Affairs and authorize the holding of the First International Congress on Diseases of the Chest in Rome, Italy, in the fall of 1950.

Upon motion by Dr. Louis Mark and seconded by Dr. S. U. Marietta, the report of the Council on International Affairs was approved in its entirety.

Dr. Russell S. Anderson, Chairman of the Council of Tuberculosis Hospitals, presented a progress report. This council has conducted a number of preliminary meetings at which time matters concerning tuberculosis hospitals and sanatoria were discussed. A full report of the council will

be published as soon as the program under way has been completed. The report presented by Dr. Anderson was moved for approval by Dr. William E. Hudson, seconded by Dr. S. U. Marietta, and unanimously adopted.

Dr. Robert J. Anderson, Chairman of the Council on Public Health, presented the following report of the meeting of the council held in Atlantic City on June 2:

Council on Public Health, Members Present:

Dr. Robert J. Anderson, Washington, D. C., Chairman
Dr. Benjamin L. Brock, Downey, Illinois
Dr. Clifton Hall, Springfield, Illinois
Dr. Robert G. McCorkle, San Antonio, Texas
Dr. John M. Preston, Columbia, South Carolina

*Committee on Chest Diseases in Penal and Mental Institutions, Members Present:

Dr. O. L. Bettag, Chicago, Illinois, Chairman
Dr. P. J. Sparer, Denver, Colorado

*Committee on Occupational Diseases of the Chest, Members Present:

Dr. C. Howard Marcy, Pittsburgh, Pennsylvania, Chairman
Dr. Frank R. Ferlaino, New York, New York
Dr. Charles E. Lyght, Rahway, New Jersey
Dr. F. Kenneth Albrecht, Topeka, Kansas
Invited Guests:
Dr. Ernest Teller, Chicago, Illinois
Dr. A. J. Steiner, St. Louis, Missouri

*These committees serve under the Council on Public Health.

A review of Dr. Paul A. Turner's report as chairman of the preceding council opened the meeting. This report contained references to case finding programs which became the first subject for discussion. Attention was given specifically to the "follow-up" aspects of mass surveys. The expressions of the several members present was to the effect that case-finding is not accomplished until a fairly definite working diagnosis is reached. Many mass x-ray programs do not result in diagnoses based on history, examination, or laboratory procedures including standard size x-ray films and routine bacteriological studies, as was evident from instances cited by several of the council members. Instances were also related where follow-up had been good and was reflected by statistics obtained from tuberculosis case registers. The discussion that followed was centered around the question, how to obtain such follow-up. To this problem, the educational efforts of the College can contribute much. The discussion resulted in the adoption of the following resolutions:

WHEREAS, mass surveys have demonstrated their value in the detection of chest lesions,

WHEREAS, the follow-up of all suspected cases has not always been adequately organized, and

WHEREAS, the maximum results from surveys cannot be achieved without more complete follow-up,

THEREFORE, BE IT RESOLVED, that the American College of Chest Physicians recommend to the Section on Preventive and Industrial Medicine and Public Health of the American Medical Association, and the Tuberculosis Committees of the state and local medical societies that (1) they approve the principle and practice of arriving at a working diagnosis before the case-finding effort can be considered complete, (2) that this can most expeditiously be accomplished through the referral of the x-ray suspect cases to designated, organized chest clinics or centers whether temporarily or permanently established.

The Council on Public Health then moved that the College go on record advocating the establishment and improvement of local health services.

The Council on Public Health moved that the College stress the establishment of programs of routine x-ray for all hospital admissions. It has been shown to be a productive case-finding procedure and offers educational potentialities.

Drs. Bettag and Sparer reported for the Committee on Chest Diseases in Penal and Mental Institutions. They related programs operating in certain areas and stressed the need for more study and action in this field.

Drs. Marcy, Ferlaino, Lyght and Albrecht reported for the Committee on Occupational Diseases of the Chest. They indicated that the approach to the problems would be largely one of education of industrial and chest physicians.

The Council on Public Health then adjourned.

Motion was made for acceptance of Dr. Anderson's report by Dr. Jay Arthur Myers, seconded by Dr. J. Winthrop Peabody and carried.

Dr. William C. Voorsanger, Chairman of the Council on Public Relations, presented the following report of the meeting of the council:

The Council on Public Relations met on Thursday, June 2nd at 5:00 p.m. at the Ambassador Hotel. This was the first meeting of the year. The Executive Secretary, Murray Kornfeld, presented a book of clippings from various medical journals throughout the country demonstrating that the College has received very good medical publicity during the year. The Council stressed the point that general publicity would be very valuable, particularly with the lay public, but pending the time when sufficient funds are available for this purpose the College publicity must be restricted to physicians and medical publications, except at conventions and meetings held during the year.

The Council was gratified that the general office, with limited facilities and a limited number of employees, developed the amount of publicity it did during the past year. It represented a very considerable effort.

The Council on Public Relations wishes to make a recommendation to the Board of Regents, namely that $250.00 be set aside each year as a prize for the best paper on any subject pertaining to diseases of the chest. The competition should be open to any physician in the world. A committee should be appointed known as the Medical Prize Committee or some other appropriate name. All papers presented should be in the hands of this committee in sufficient time before the annual meeting so that selection of the best one can be made. This paper should then be given priority at the annual session and the winner of the prize should read his paper in person, if possible.

The Council feels that by continuing its cooperation with the central office much can be done to put the College in a favorable light throughout the world.

Motion for approval of the report was made by Dr. Charles M. Hendricks, seconded by Dr. Louis Mark and carried.

Dr. Charles M. Hendricks, General Chairman of the Council on Research, reported on the activities of his council and presented the following motion:

This council requests the Board of Regents to authorize the incoming President of the College to appoint a committee of three members of the Research Council whose duty it will be to organize a legally-separate organization for raising funds for the purpose of carrying on research in diseases of the chest.

Dr. Louis Mark moved for the adoption of this resolution, seconded by Dr. Minas Joannides, and unanimously carried.

Dr. Placak thereupon appointed the following committee: Dr. Charles M. Hendricks, Chairman, Dr. Jay Arthur Myers, and Dr. Minas Joannides.

Dr. James H. Stygall, Chairman of the Council of Tuberculosis Committees, presented a report of the activities of his council. The council recommended that the tuberculosis committees in the state medical

societies be requested to cooperate with the Council on Public Health of the College for the purpose of obtaining statistical information regarding admission of tuberculous patients in general hospitals. Dr. Minas Joannides moved that this recommendation be approved, seconded by Dr. William E. Hudson, and carried.

Dr. Edwin R. Levine, Chairman of the Council on the Management and Treatment of Diseases of the Chest gave a progress report of his council which was referred back to committee for the purpose of adjusting several details. That part of the report dealing with the establishment of a Committee on Physiologic Treatment of Chest Diseases was approved by the Board. A full report of this council will be published at a later date.

Dr. Richard H. Overholt requested that resolutions recommending approval of the Senate and House of Representatives bills regarding the use of living animals for scientific investigation be prepared and brought before the administrative session of the College for adoption. The motion was approved by Dr. James H. Stygall, seconded by Dr. Carl C. Aven, and carried. The President of the College appointed a committee comprising Dr. S. U. Marietta and Dr. M. Jay Flipse to prepare the resolutions. These resolutions were approved by the membership at the administrative session held on Saturday, June 4, and are as follows:

WHEREAS, There has been introduced into the Senate and the House of Representatives of the United States Congress similar measures identified as S1703 and HR4349 "to provide that unclaimed animals lawfully impounded in the District of Columbia be made available for scientific purposes to educational, scientific and governmental institutions licensed under this act," and

WHEREAS, The passage of these measures would eliminate cruelties to animals through proper preparation and painless experimentation by licensed individuals or institutions, and

WHEREAS, The use of animals for such purposes would advance the teaching of medicine and assist in the development of new methods of treatment of human disease to the benefit of mankind;

NOW, THEREFORE, BE IT RESOLVED, By the American College of Chest Physicians duly assembled at its annual meeting in Atlantic City that Senate Bill S1703 and House of Representatives Bill HR4349 be hereby approved and recommended for passage by the bodies concerned, and

FURTHERMORE, BE IT RESOLVED, That copies of this resolution be spread upon the minutes of the American College of Chest Physicians and that copies be sent to each member of the Senate and House Committee for Health and Research and also to the President of the United States.

WHEREAS, there has been introduced in the House of Representatives of the Congress of the United States a bill identified as HR857 "to prohibit experimentation on living dogs in the District of Columbia and provide penalties for violation thereof," and

WHEREAS, the passage of this bill would prevent scientific investigation of the cause and treatment of diseases in humans by the several colleges, medical schools and hospitals including those operated by the federal government in said district, and

WHEREAS, the passage of the bill would set a precedent which might eventually threaten the entire country with similar legislation to the great detriment of medical progress including the teaching of medicine and development of new remedies for the treatment of human disease,

THEREFORE, BE IT RESOLVED, by the American College of Chest Physicians duly assembled at its annual meeting at Atlantic City that this legislation HR857 be disapproved, and

FURTHERMORE, BE IT RESOLVED, that copies of this resolution be spread upon the minutes of the American College of Chest Physicians

and that copies be sent to each member of the Senate and House Committee for Health and Research and also to the President of the United States.

Mr. Murray Kornfeld read a letter received from Sir Sidney Sewell of Melbourne, Australia, Regent of the College, which was written shortly before his death. Dr. Paul A. Turner proposed that all present stand for a minute of silence to the memory of the departed dear friend and colleague.

Telegrams received from Dr. Andrew L. Banyai, Milwaukee, Wisconsin, Dr. Harry C. Warren, San Francisco, California, and Dr. Hollis E. Johnson, Nashville, Tennessee, expressing regret at not being able to attend the meeting because of illness in their families, were read and the Executive Secretary was authorized to send appropriate replies to each of these members of the Board of Regents.

Dr. Andrew L. Banyai was elected by the Board of Regents to serve as a member of the Committee on Nominations.

Dr. James H. Stygall was elected by the Board of Regents to the Executive Council.

Dr. William A. Hudson was re-elected as Historian of the College.

Dr. Paul A. Turner was re-elected Chairman of the Board of Regents.

Meeting adjourned.

Scientific Exhibits, American Medical Association Section on Chest Diseases

The first Section on Chest Diseases in the Scientific Exhibits of the American Medical Association was presented at the Atlantic City meeting last month. There were nine exhibits in the section, all of which attracted a great deal of interest. The exhibit on "Tumors of the Lung—A Pathologic Study of Surgical Lesions" presented by Drs. J. R. McDonald, L. B. Woolner and A. H. Bulbulian of the Mayo Clinic, Rochester, Minnesota, was awarded the Bronze Medal.

First Section on Diseases of the Chest American Medical Association

The first meeting of the Section on Diseases of the Chest in the American Medical Association was held in Atlantic City on Wednesday, June 8 and Thursday, June 9. Registration at the meeting was 384, as reported by the American Medical Association, placing the Section on Diseases of the Chest in ninth place among the eighteen scientific sections.

At the Executive Session held on Thursday, June 9, the following officers were elected:

Walter E. Vest, M.D., Huntington, West Virginia, Chairman
Alvis E. Greer, M.D., Houston, Texas, Vice-Chairman
Jay Arthur Myers, M.D., Minneapolis, Minnesota, Secretary
Hollis E. Johnson, M.D., Nashville, Tennessee, Delegate
Karl H. Pfuetze, M.D., Cannon Falls, Minnesota, Alternate

Dr. S. U. Marietta, who served as chairman of the Section during the preceding year and Dr. Jay Arthur Myers who served as Secretary are to be congratulated upon the splendid program arranged. Dr. Myers was re-elected to serve as Secretary of the Section for a three year term.

College News Notes

Dr. Chevalier L. Jackson was recently elected to the executive committee of the Philadelphia Laryngological Society.

Dr. Paul H. Holinger, Chicago, Illinois, presented a paper on endoscopic cinematography at the Fourth International Congress of Otolaryngology held in London, England, July 17-24. From London, Dr. Holinger went to Lisbon, Portugal to address a group of otolaryngologists. Following this he will travel to South America where he will present papers and postgraduate courses in endoscopy in Buenos Aires and Santa Fe, Argentina, and Rio de Janeiro and Sao Paulo, Brazil.

Dr. Joseph Burrascano of New York City recently spoke before the New York University Institute of Rehabilitation on "The Diagnosis and Control of Tuberculosis."

Copies of the outline on "The Pneumoconioses" which Dr. Oscar A. Sander of Milwaukee, Wisconsin, presented at the round table discussion on "Dust Diseases" held at the annual meeting of the College in Atlantic City, are available for distribution to interested physicians. Please write to the Executive Offices of the College, 500 North Dearborn Street, Chicago 10, Illinois, for copies.

Professor Lopo de Carvalho Visits the United States

Professor Lopo de Carhalho (third from left), newly elected Regent of the College, of Lisbon, Portugal; his wife and Madeiros Galvao, M.D. (right), Medical Director of the Vasconcellos Porto Sanatorium, Portugal; visiting with Marcio Bueno, M.D., Medical Director of the Fall River Tuberculosis Hospital, Fall River, Massachusetts, after attending the Annual Meeting of the American College of Chest Physicians in Atlantic City, June 2-5, 1949.

Dr. Evarts A. Graham Receives College Award

Dr. Graham was presented with the College Medal and Certificate of Award for meritorious achievement in the specialty of diseases of the chest at the annual meeting of the College in Atlantic City. The Award was made by Dr. Jay Arthur Myers, Minneapolis, Minnesota, Chairman of the Committee on College Awards, at the Annual Presidents' Banquet held at the Ambassador Hotel on June 4. Dr. Myers' introductory remarks appear on the opposite page.

Dr. Evarts Ambrose Graham

On May 12, 1931, as chairman of the Committee on Award of the National Tuberculosis Association I had the honor of presenting the Trudeau Medal to the physician who was one of the world's finest students of tuberculosis. This was Allen K. Krause of the Johns Hopkins University. Tonight it is my honor on behalf of the Committee on College Awards of the American College of Chest Physicians to present the 1949 College Medal and Certificate of Award to one of the world's most famous chest surgeons. He was born in Chicago on March 19, 1883. After attending public school and Lewis Institute of that city, he entered Princeton University and received the degree of Bachelor of Arts in 1904. Rush Medical College, Chicago, conferred upon him the degree of Doctor of Medicine in 1907. After completing an internship at Presbyterian Hospital, he spent four years as fellow and special student in pathology and chemistry at Rush Medical College and the University of Chicago. During a part of this time and until 1914, he was assistant in surgery at Rush Medical College.

Having become highly qualified, he was appointed to a professorship in surgery at Washington University School of Medicine and became surgeon-in-chief at Barnes Hospital and St. Louis Children's Hospital, St. Louis, Missouri, in 1919. Thus, he has served in these capacities for three decades.

During World War I he was major, Medical Corps, United States Army, with the Empyema Commission in 1918 and was later commanding officer, evacuation hospital, number 34, in France. As chairman of the Empyema Commission he observed that about one half of the soldiers who had developed acute empyema following influenzal pneumonia had died. It was well known by him that pneumonia causes a marked temporary reduction in vital lung capacity and he was convinced that open drainage had been established in many of these cases too soon, that is, before the empyema or the pleural abscess was well established and while the vital lung capacity was still markedly reduced. Opening the thorax at that time allowed air to equalize the pressure in the pleural cavity, which not only affected the diseased lung, but because of the unstable mediastinum in the absence of adhesions and induration there was considerable encroachment upon the contralateral lung often so much as to result in asphyxiation. Therefore, many soldiers were dying, not from empyema or pneumonia, but from too early surgical interference.

The Commission adopted the closed method often with only an aspirating needle until the empyema was definitely established and the pneumonia so under control that vital capacity was not markedly reduced. If further treatment was still necessary open drainage through rib resection was employed. Soon the mortality markedly decreased under this treatment, which has since resulted in the saving of large numbers of lives.

Already I perceive that you have identified the recipient of the Medal, Dr. Evarts Ambrose Graham. You will recall that he developed cautery pneumonectomy at a time when little was being done for cases of both unilateral and bilateral bronchiectasis whose disease had not been controlled and lobectomy was not considered wise or was impossible at that time. Many persons were definitely benefited by this procedure.

In 1933, Drs. Graham and Singer reported the case of a physician for whom they had removed the left lung for carcinoma of the bronchus.

This was the first case of total removal of a lung for carcinoma in a one-stage operation recorded in the world's literature. In due time this physician returned to his office and is still practicing medicine in Pittsburgh, Pennsylvania. This successful operation encouraged Dr. Graham and stimulated many others to consider similar surgery. Progress has been so rapid that today such procedures as lobectomy, pneumonectomy and segmental resections in many parts of the world are restoring invalids not only with cancer, but also with bronchiectasis and other conditions to good health and are saving the lives of many. The pioneer work in surgery of the chest of Dr. Graham and the fine techniques he subsequently developed are responsible in no small way, not only for the rapid advances in chest surgery, but also for the skill with which operations are performed.

Dr. Graham has always had the courage of his convictions. For example, when wild enthusiasm was being manifested for x-ray and radium therapy for pulmonary malignancy, he openly condemned the procedure as never having resulted in a cure for cancer. Again, when bronchoscopists and others were advocating the removal of bronchogenic carcinoma by bronchoscopic methods, Dr. Graham pointed out the utter impossibility of removing all malignant tissue in this manner. He strongly recommended lobectomy or pneumonectomy in order that the entire cancer might be extricated with certainty. He stoutly maintained that every benign bronchial adenoma should be treated by drastic surgery rather than bronchoscopy since a considerable percentage may become malignant.

Dr. Graham holds membership in a large number of medical and scientific organizations in various nations. He has been president of the American Surgical Association, the American College of Surgeons and the American Association for Thoracic Surgery. He has contributed numerous articles to the medical and surgical literature, as well as books. He was co-editor of *Archives of Surgery* from 1920 to 1946, and of the *Annals of Surgery* since 1934. Since 1925 Dr. Graham has edited the *Year Book of Surgery*. Here he has brought together annually in one volume, the outstanding contributions of the world in surgery. This has been a fine service to surgeons everywhere. Since 1931 he has been editor of the *American Journal of Thoracic Surgery*. He and his associate editors have selected a fine array of articles for publication which have dealt with practically every phase of chest surgery and closely allied subjects.

He has been in great demand on committees, boards, etc. In 1922 he was sent by Rockefeller Foundation to Great Britain to investigate teaching of surgery in British medical schools. From 1925-39 he was a member of the Medical Fellowship Board, National Research Council, from 1937-41 chairman, American Board of Surgery, and 1940-46 chairman, Committee on Surgery, National Research Council. For nine years he served as a member of the National Board of Medical Examiners.

Six fine universities in the United States and Canada have conferred upon him the degree of Doctor of Science, and others the degree of Doctor of Law. He has been called to give special lectures to all parts of the United States and to Australia and England. Obviously the accomplishments of this man and his recognition around the world classifies him as one of the truly great world citizens of all time.

Now, Dr. Graham, with sincere adoration and esteem, I have the high honor and profound pleasure of presenting to you the 1949 Medal and Certificate of Award of the American College of Chest Physicians.